



心电散点图中的重要标识 线

河南省心电学诊疗中心

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题纲

- 1 概述
- 2 Lorenz散点图中的重要标识线
- 3 差值散点图中的重要标识线
- 4 二维差值散点图的三维特性
- 5 重要标识线的临床应用
- 6 小结

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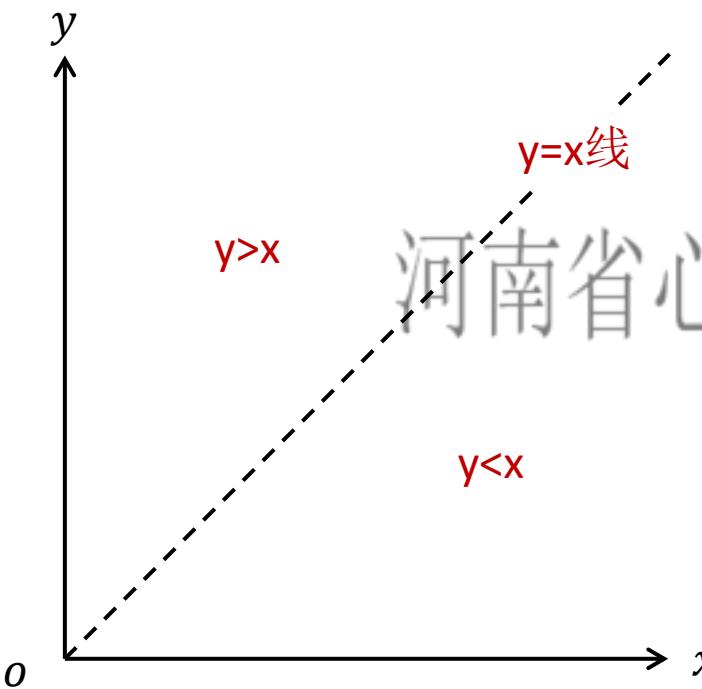
1 概述

- RR间期的大小对比及恒变性质决定着散点图的分布规律（散点图位置及走向）。
- 由于Lorenz散点图与差值散点图的作图原理不同，平面直角坐标系中位置相同的特征线有不同的名称及含义。
- 了解两种散点中的重要标识线，有利于快速识别和分析多数心律失常。

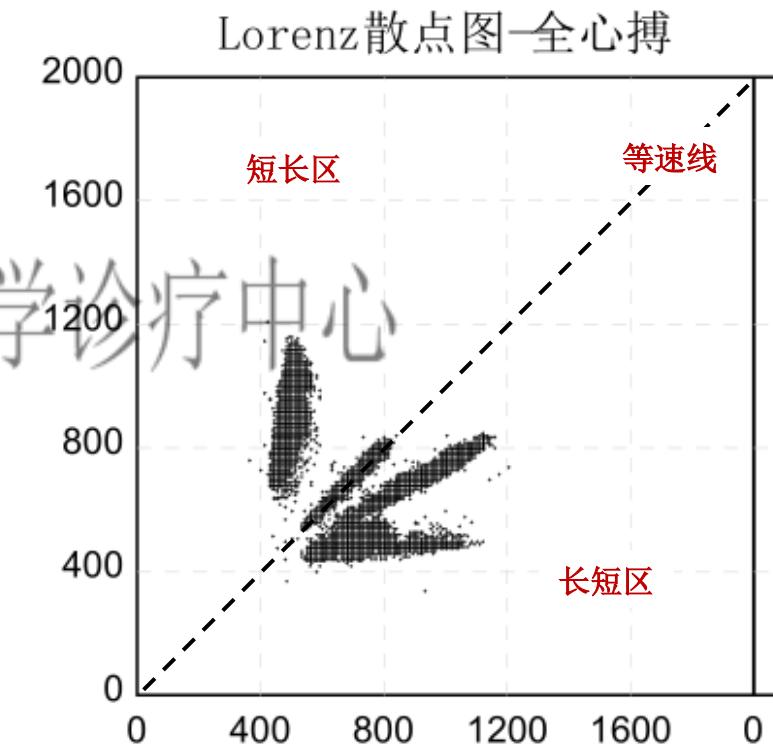
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O r e n z 散 点 图 中 的 重 要 性

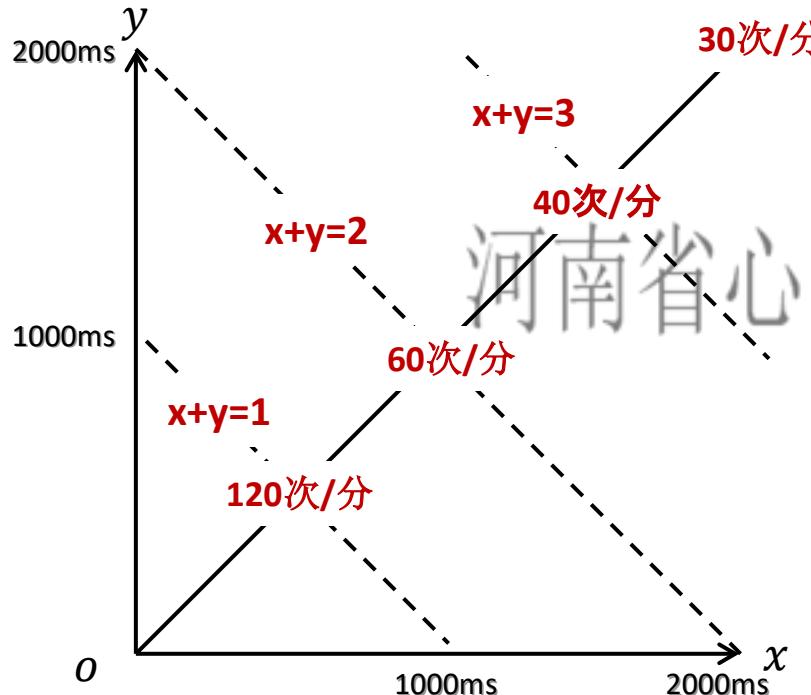


等速线

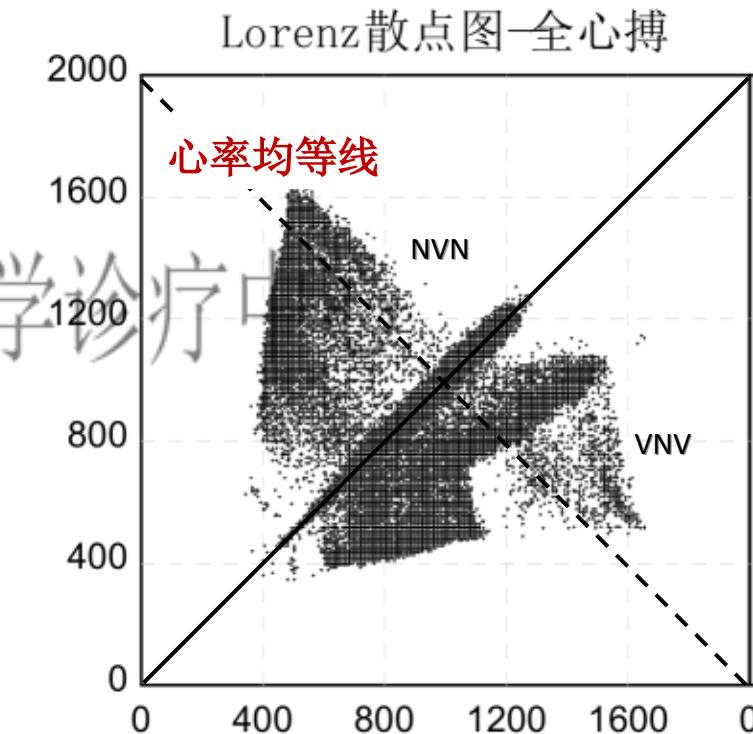




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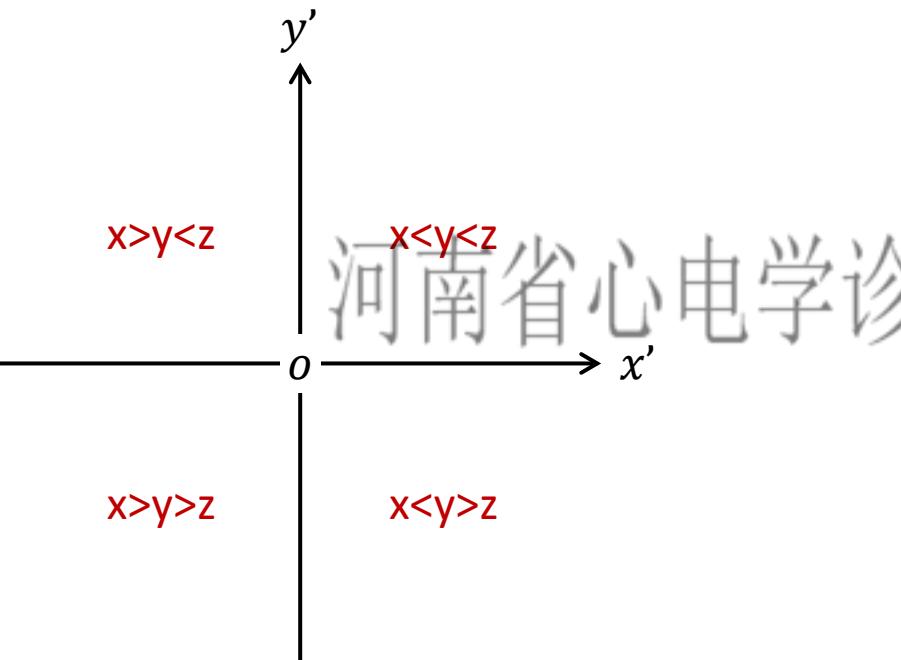


心率均等线

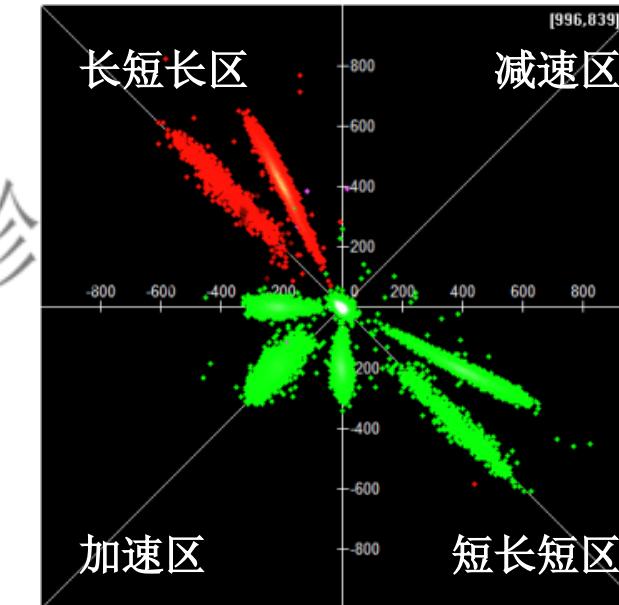




差值散点图中的重要标识线

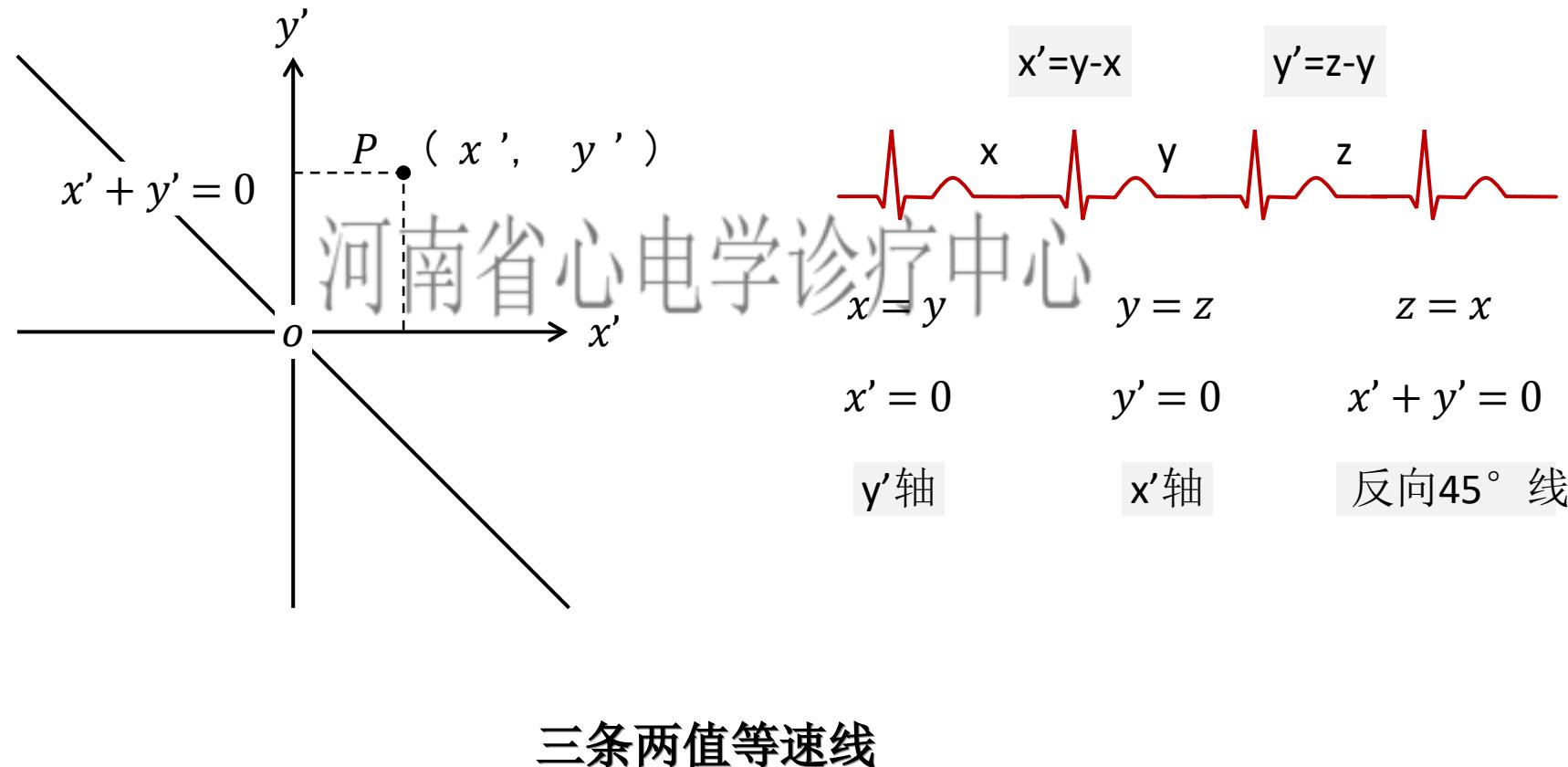


两轴分四区



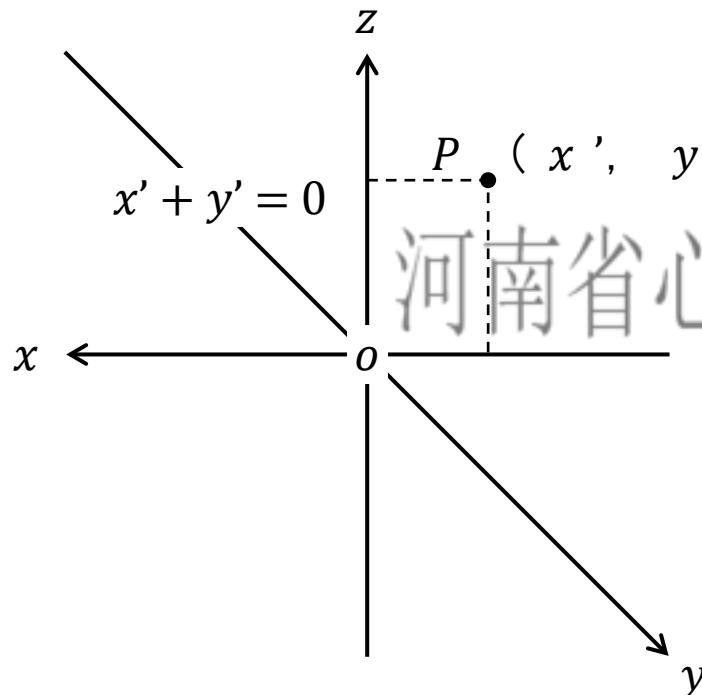


差值散点图中的等效三维坐标系

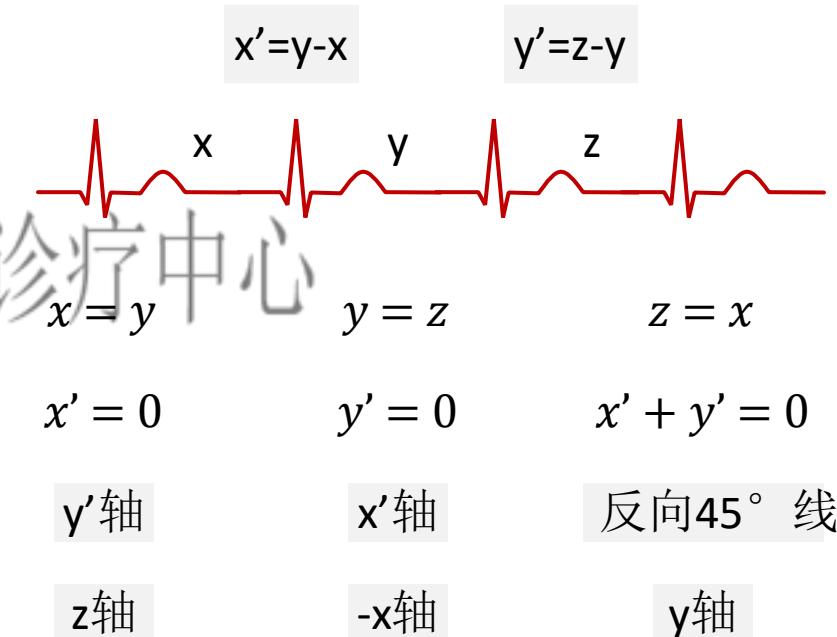




差值散点图中的等效三维坐标系

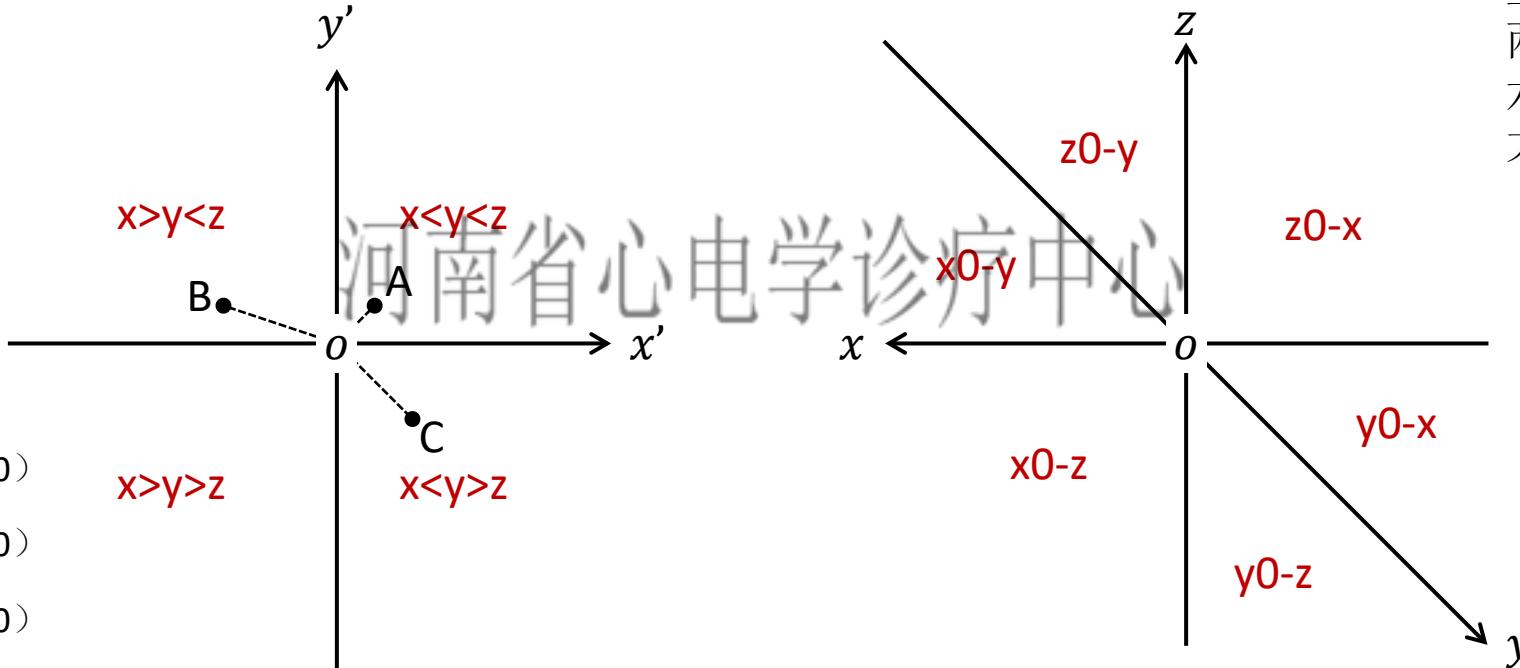


三条两值等速线



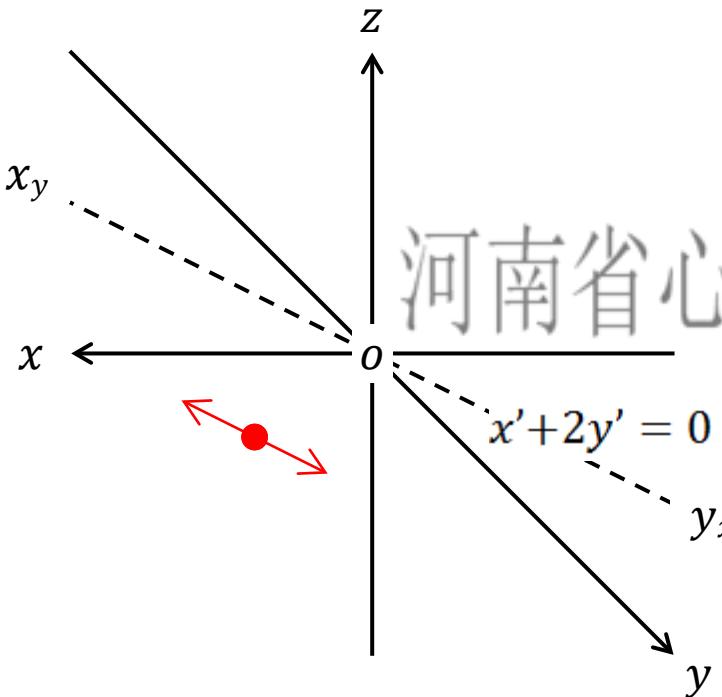


差值散点图的坐 分 区





差值散点图中的心率均等线



xy心率均等线

$$\frac{x+y}{2} = a \quad z = b$$

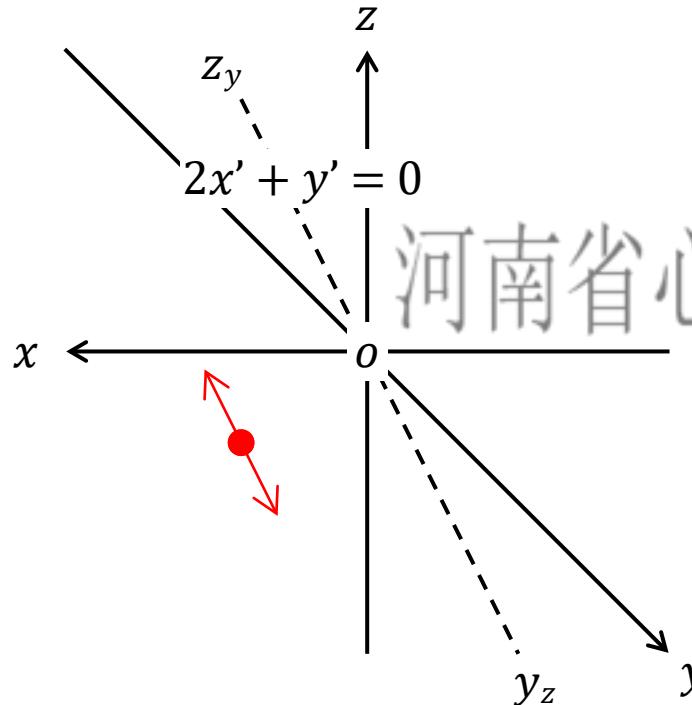
$$\begin{cases} x' = y - x = 2a - 2x \\ y' = z - y = b - (2a - x) \end{cases}$$

$x' + 2y' = 2b - 2a$

三族两值心率均等线



差值散点图中的心率均等线



yz心率均等线

$$\frac{y+z}{2} = a \quad x = b$$

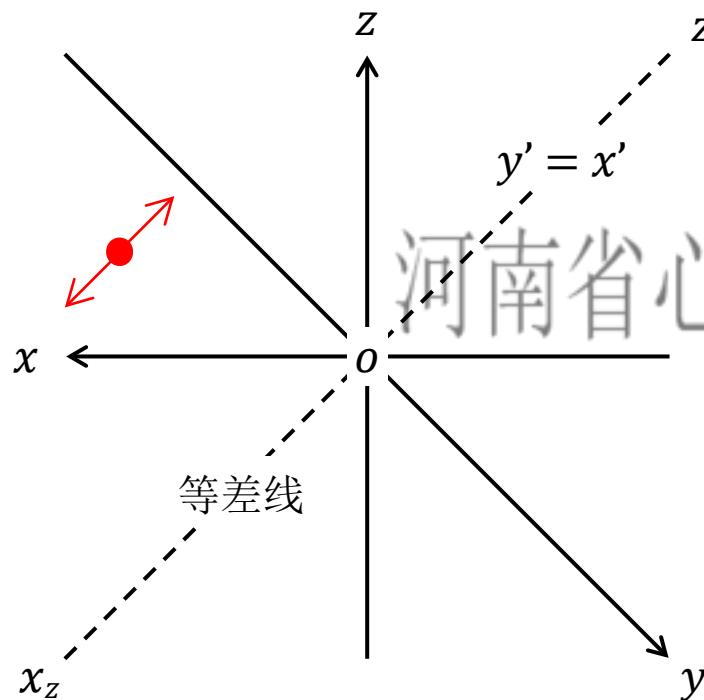
$$\begin{cases} x' = y - x = 2a - z - b \\ y' = z - y = z - (2a - z) \end{cases}$$

$$2x' + y' = 2a - 2b$$

三簇两值心率均等线



差值散点图中的心率均等线



三簇两值心率均等线

zx心率均等线

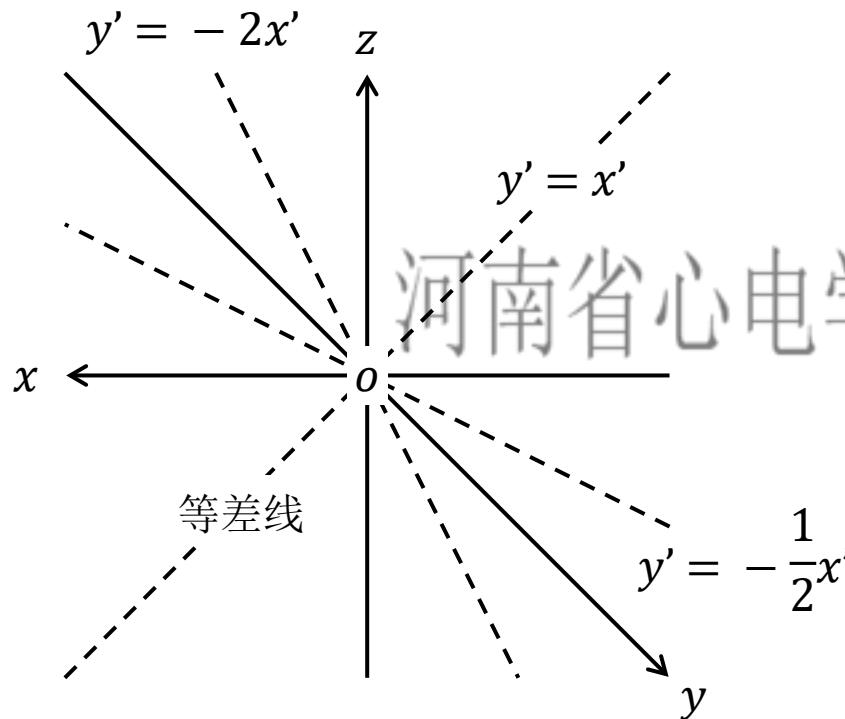
$$\frac{x+z}{2} = a \quad y = b$$

$$\begin{cases} x' = y - x = b - x \\ y' = z - y = 2a - x - b \end{cases}$$

$$x' - y' = 2b - 2a$$



差值散点图中的心率均等线



三条两值心率均等线

$$y' = x'$$

$$z - y = y - x$$

$$y = \frac{z + x}{2}$$

$$y' = -2x'$$

$$z - y = -2(y - x)$$

$$x = \frac{y + z}{2}$$

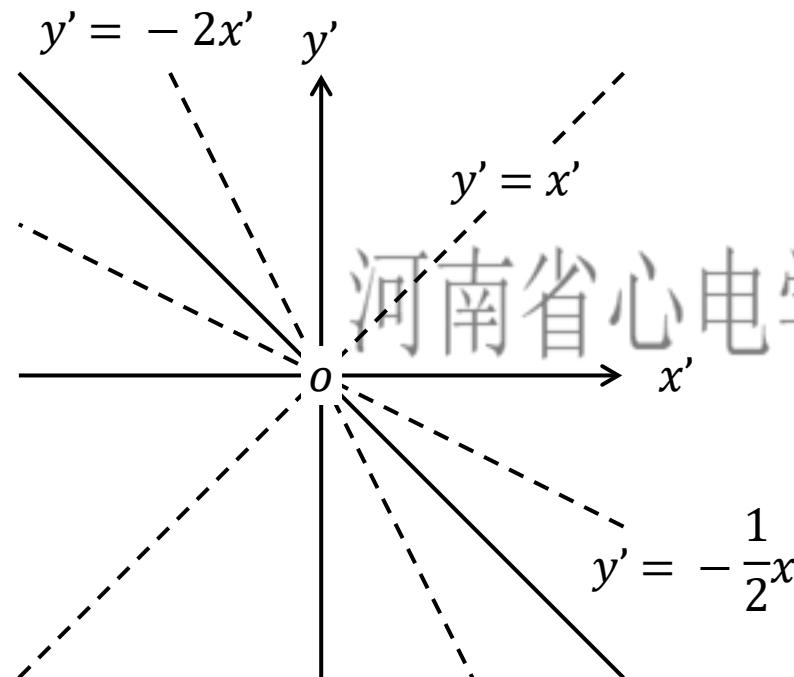
$$y' = -\frac{1}{2}x'$$

$$-2(z - y) = y + x$$

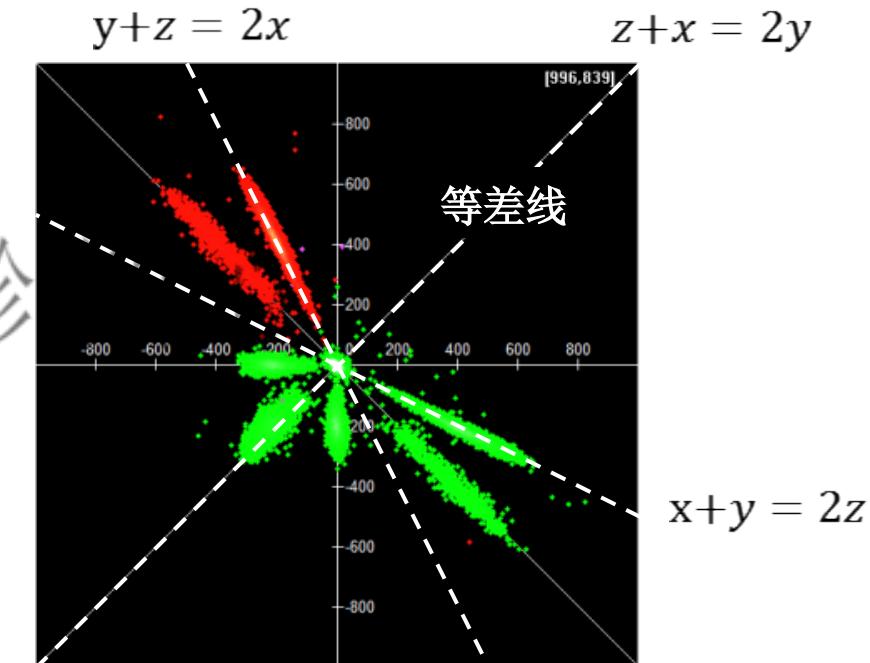
$$z = \frac{x + y}{2}$$



差值散点图中的重要标识线



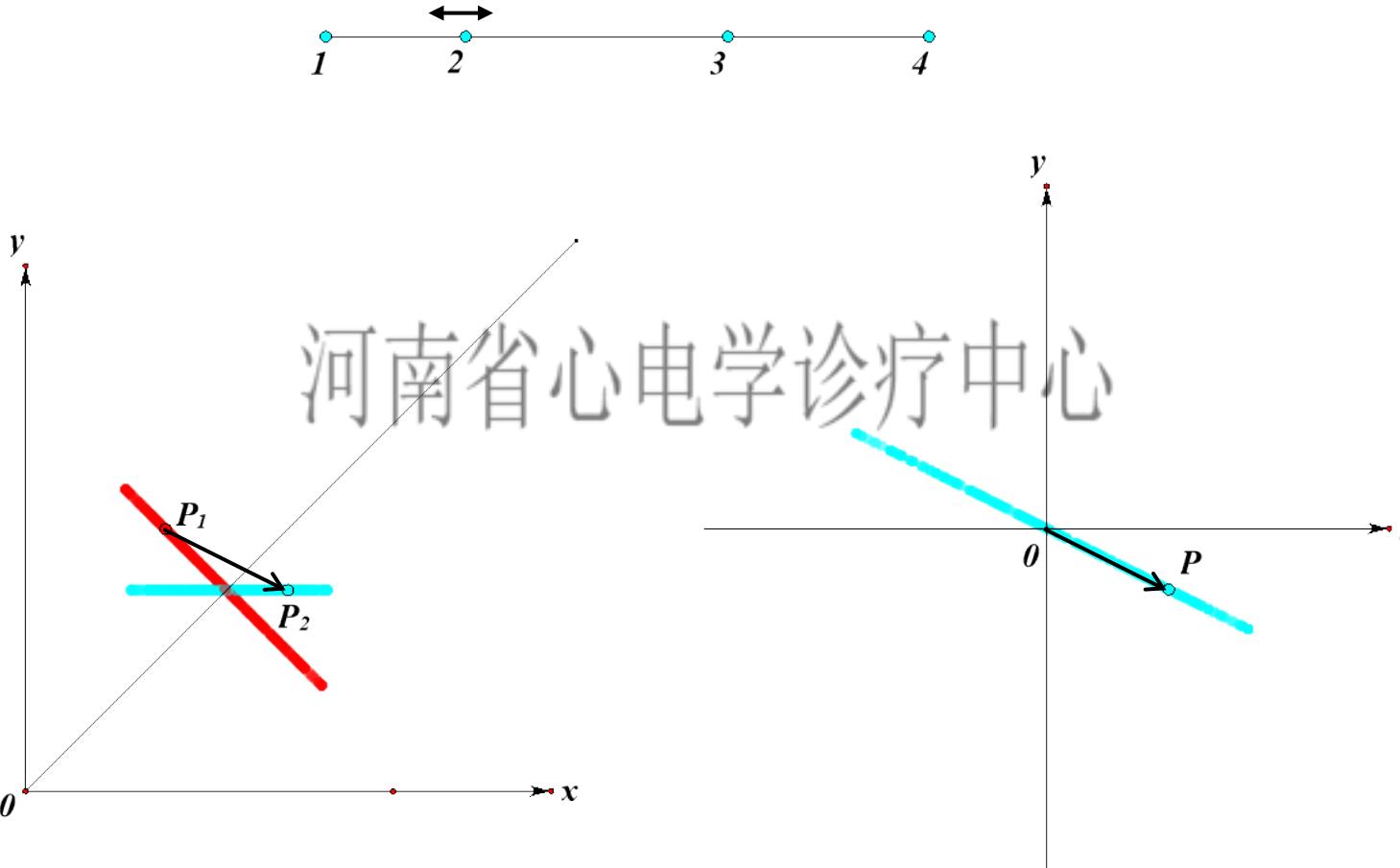
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三条两值心率均等线

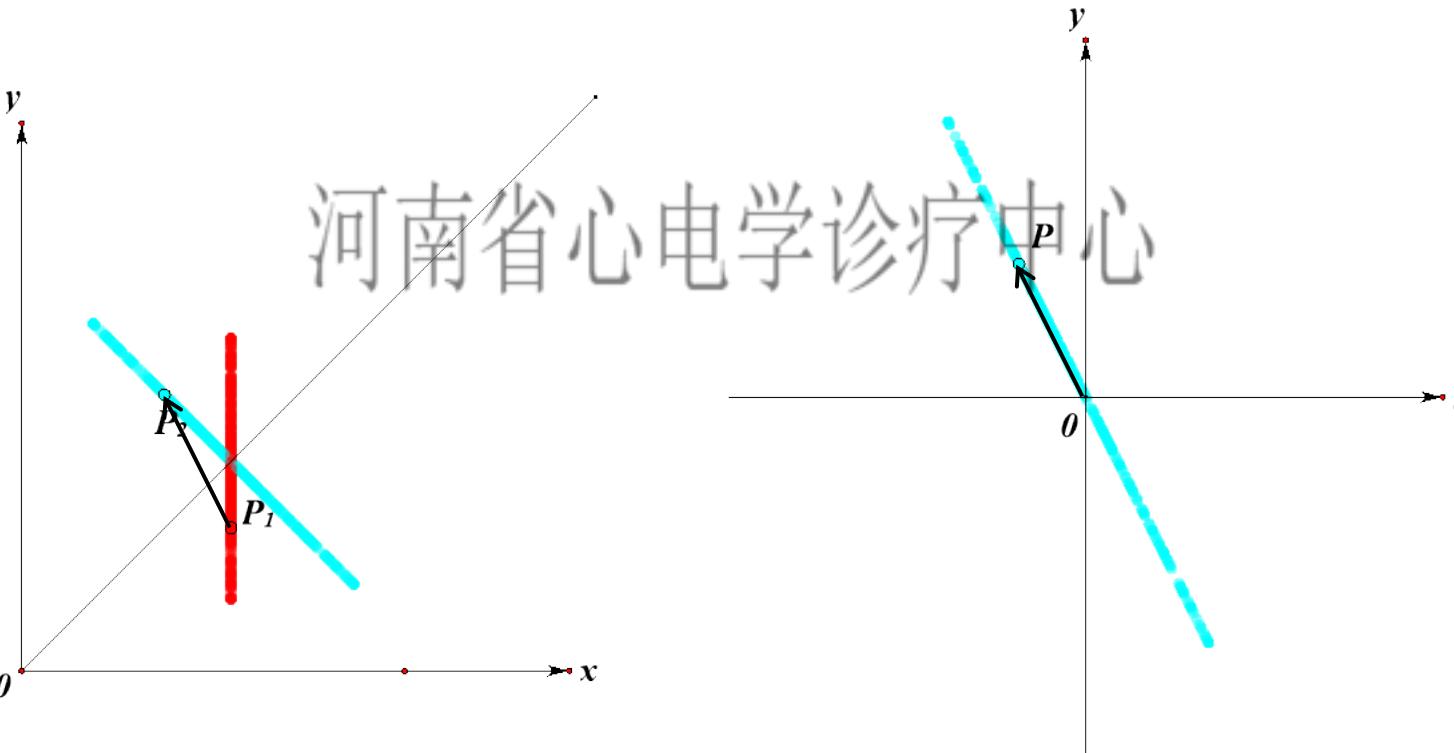
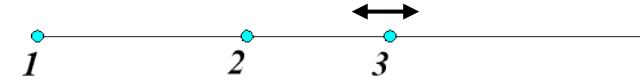


差值散点图中的重要标识线



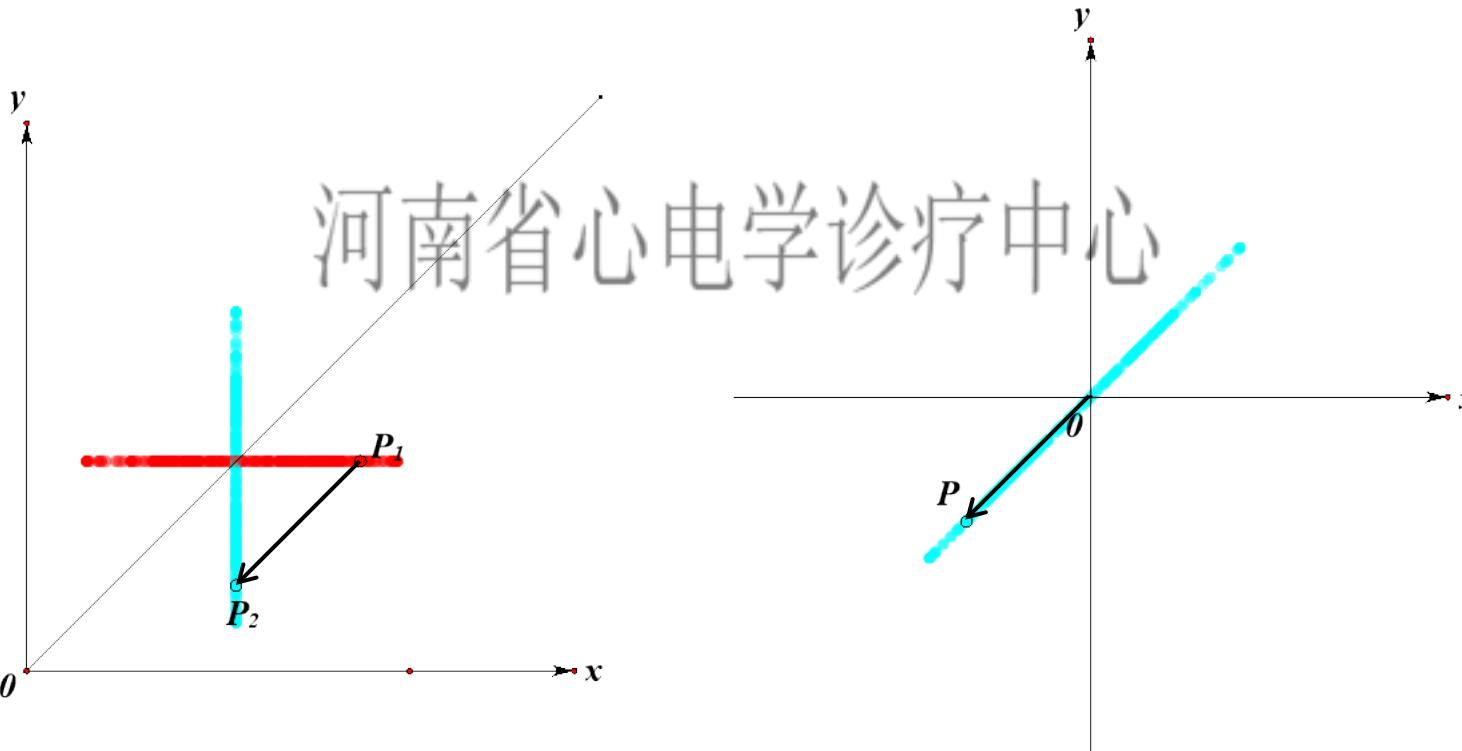
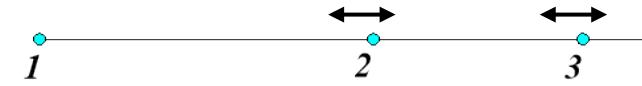


差值散点图中的重要标识线





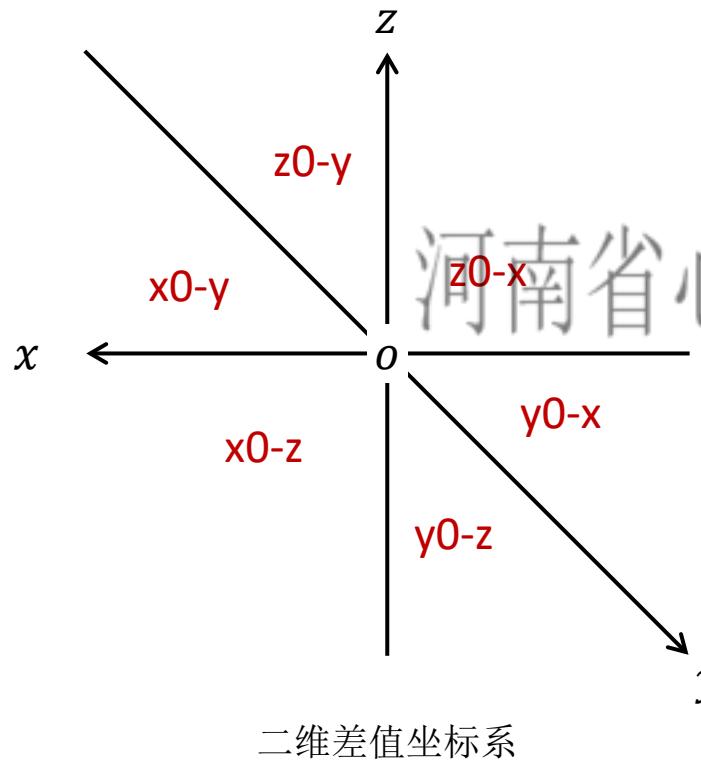
差值散点图中的重要标识线



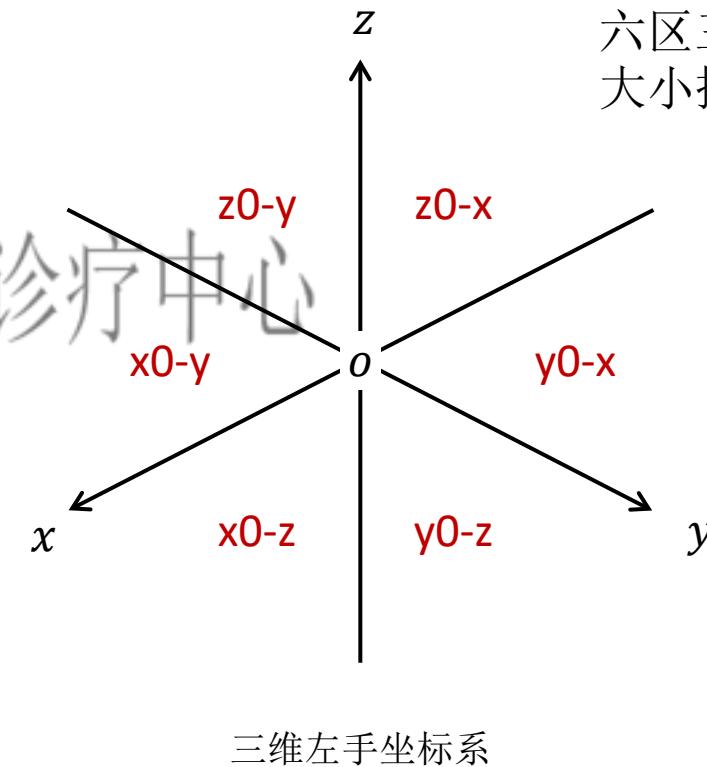
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维差值散点图的三维特性



二维差值坐标系



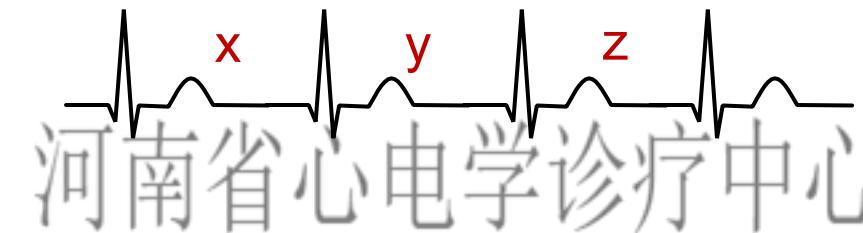
三维左手坐标系

三值相等居正中
两值相等守边疆
六区三值各不等
大小排序看名称



4 三维Lorenz散点图的概念

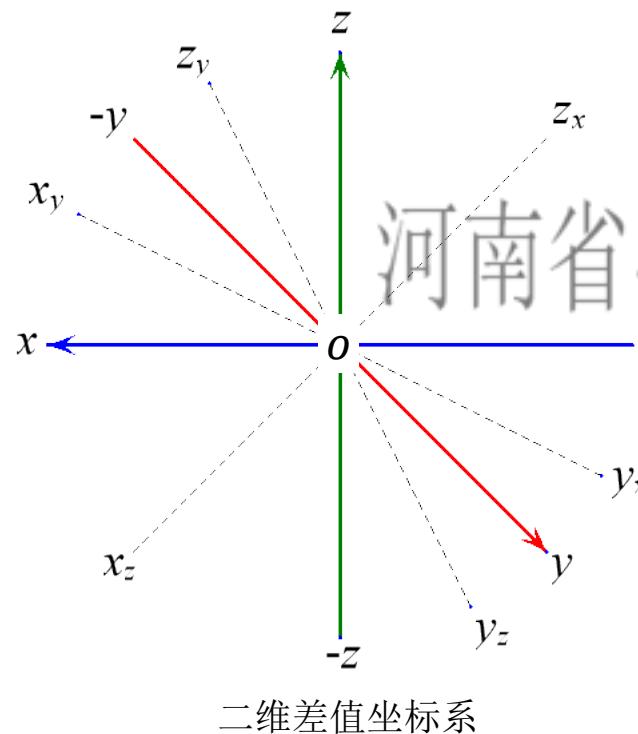
- 是以空间点的位置表达相邻RR间期的规律性。



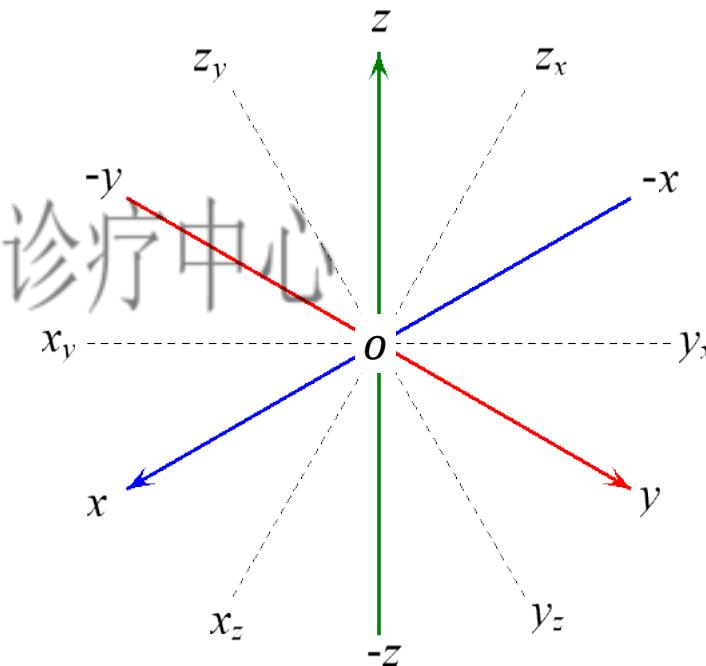
$$\begin{array}{ccc} \text{三维Lorenz散点} & P(x \ y \ z) & \\ & \xrightarrow{\begin{array}{c} x' = y - x \\ y' = z - y \end{array}} & \\ \text{二维差值散点图} & P(y - x, \ z - y) & \end{array}$$



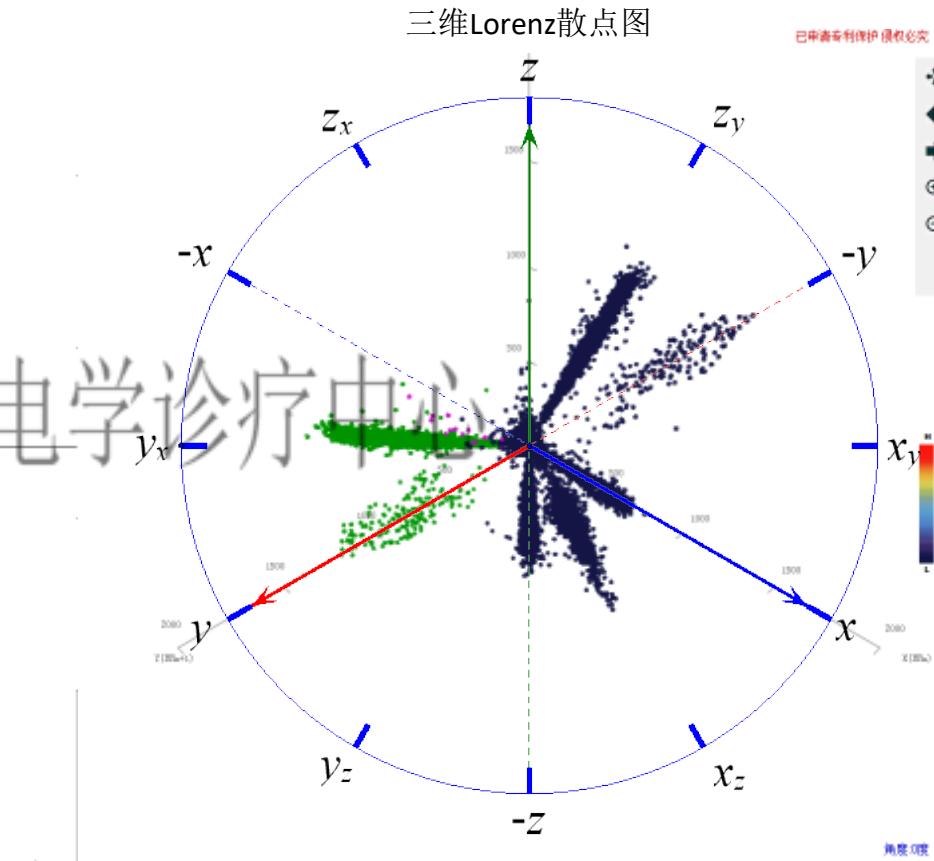
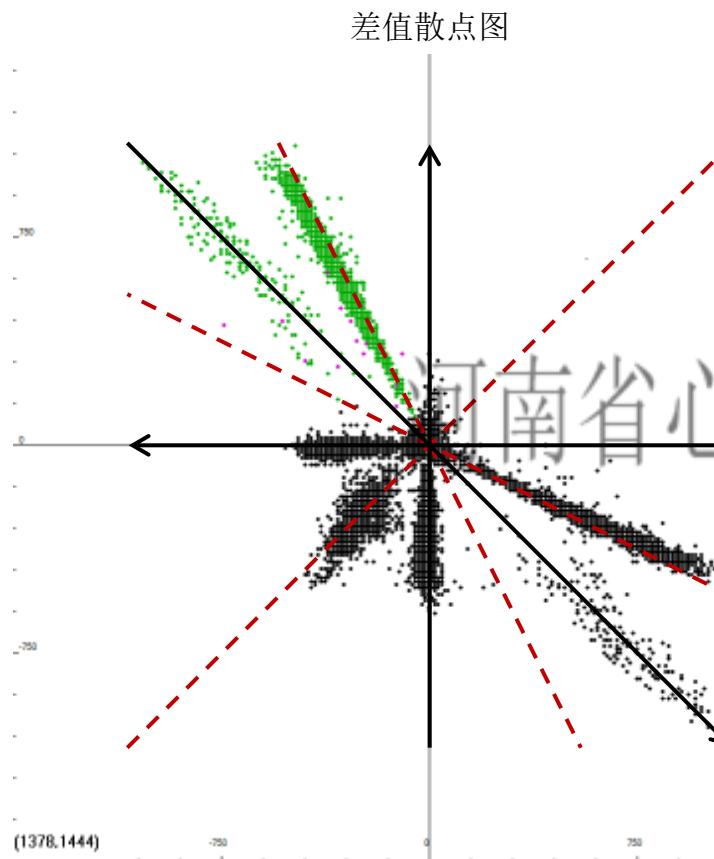
维差值散点图的三维特性



二维差值坐标系



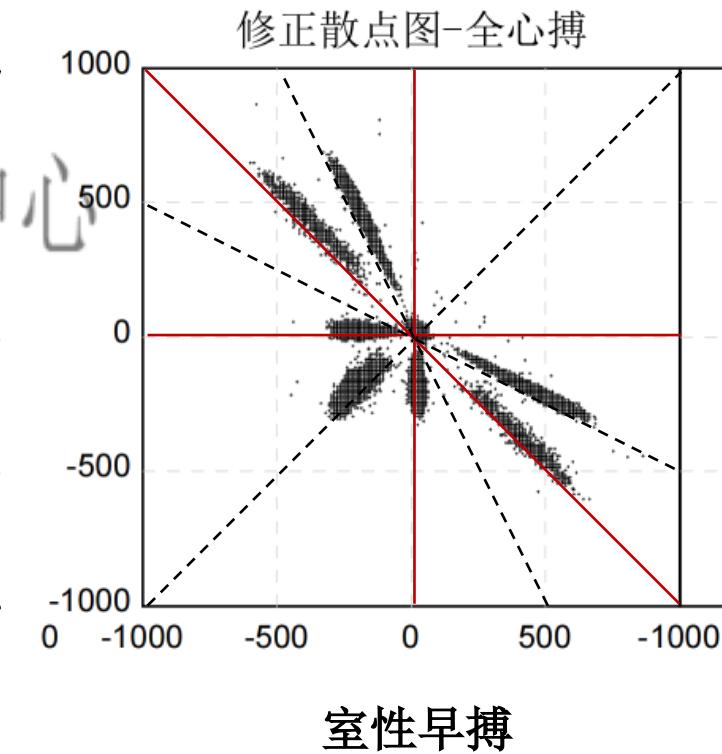
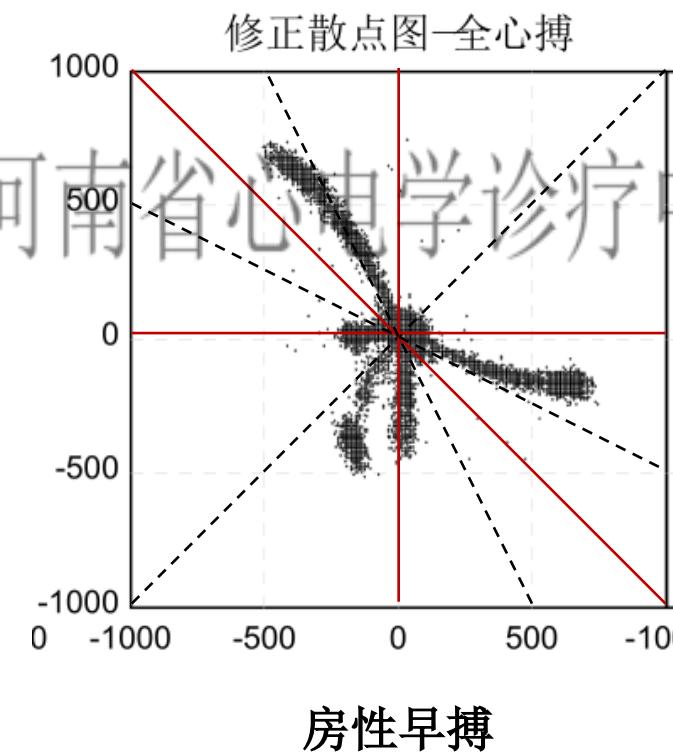
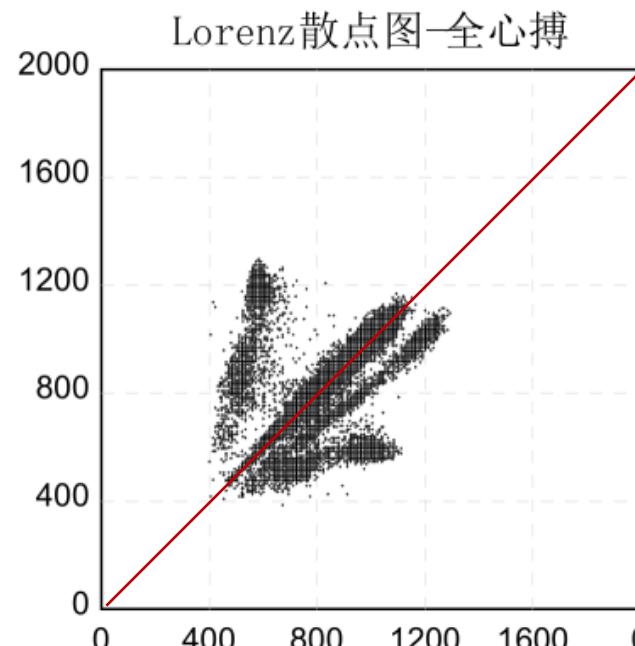
三维左手坐标系





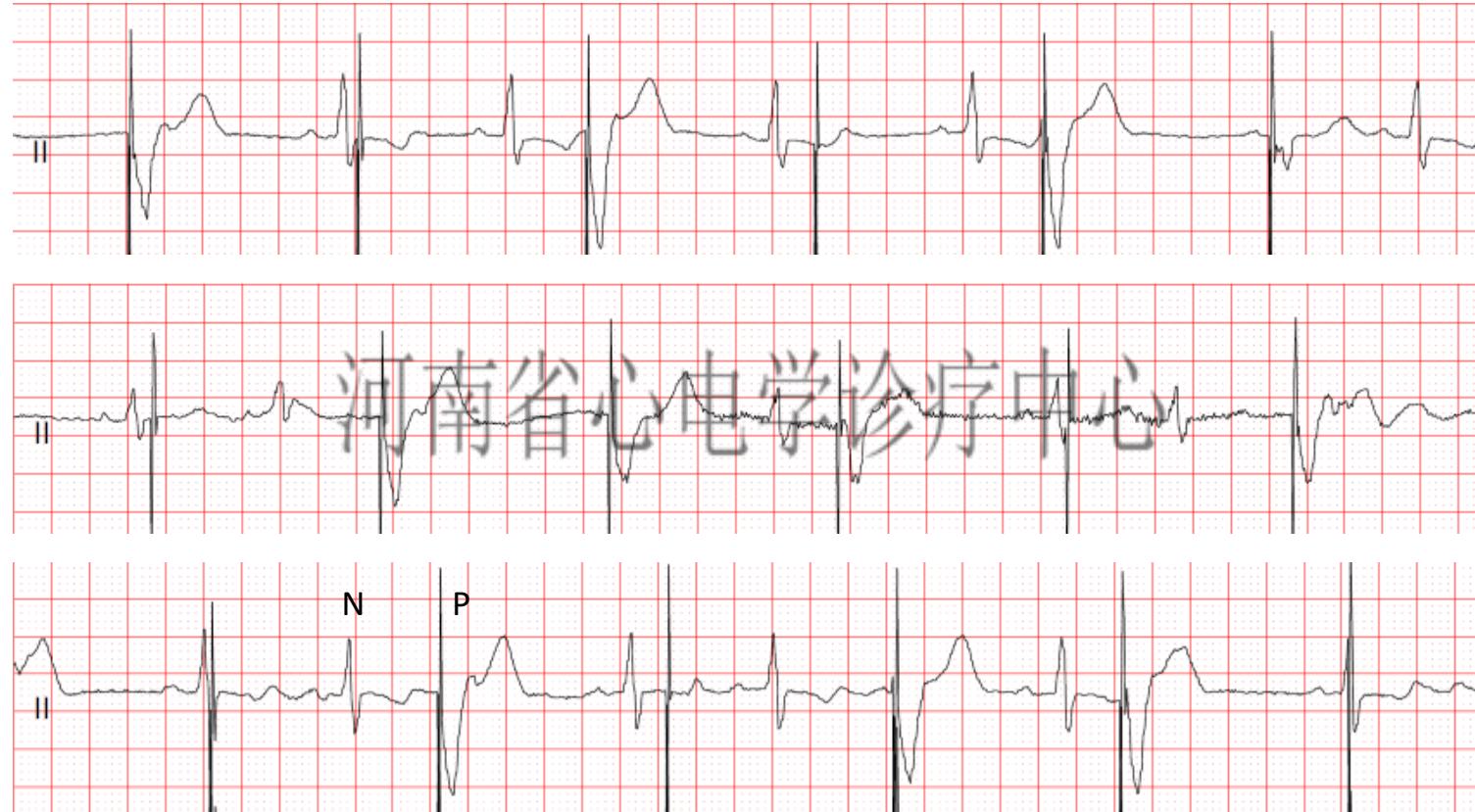
5 重要标识线的临床应用

例1 快速识别早搏的代偿间歇





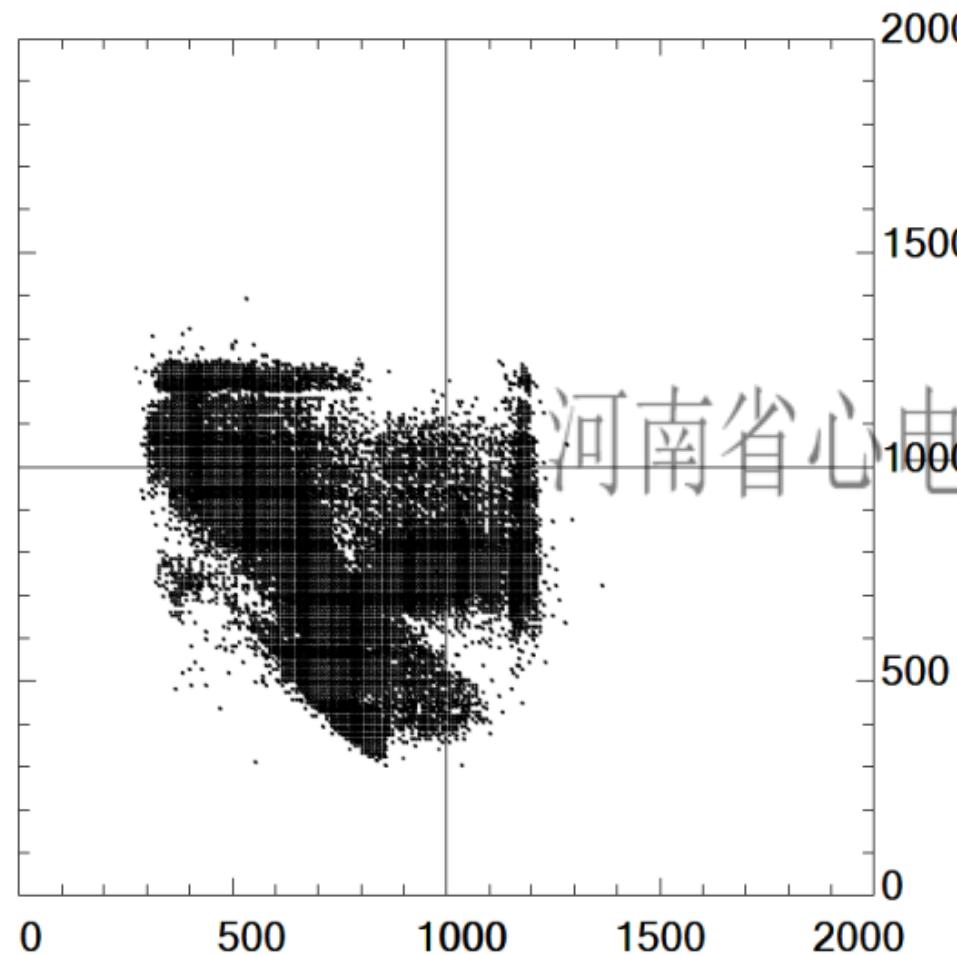
例2 快速识别并行心律



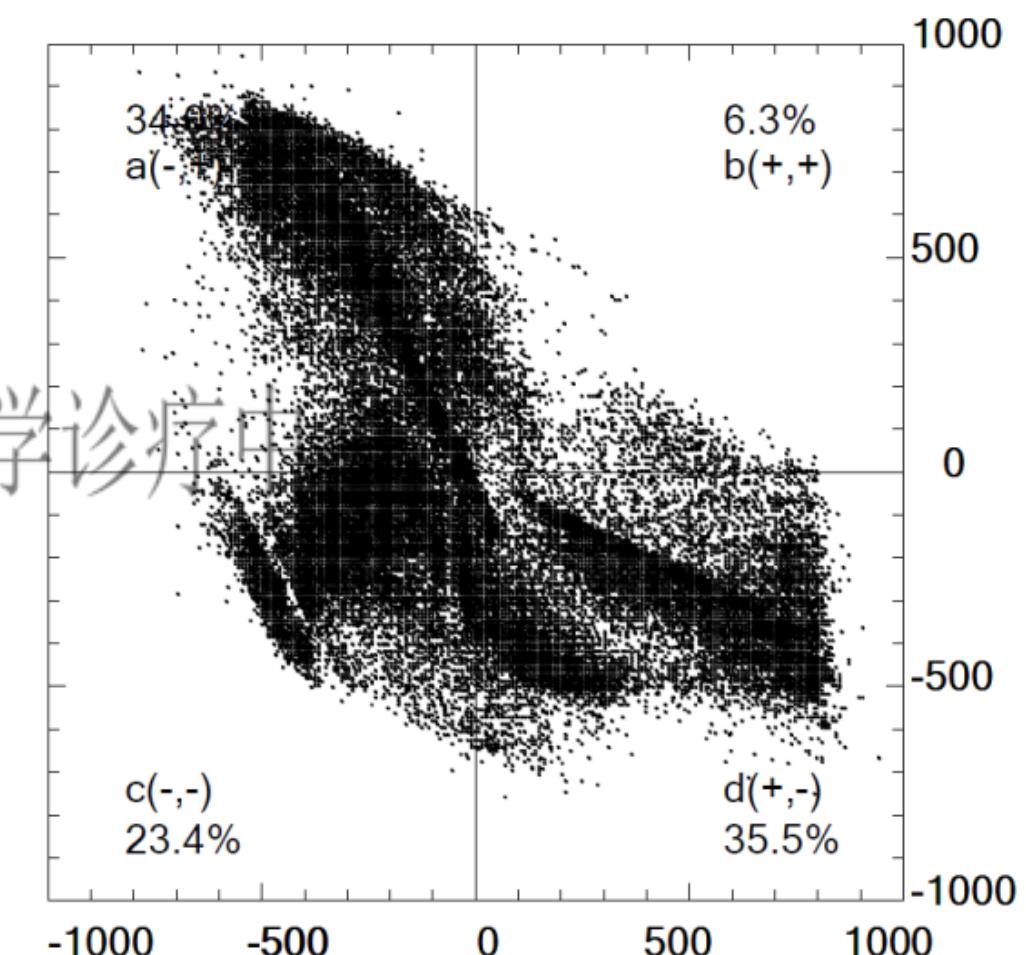
竞争性起搏心律



Lorenz 散点图 - 全部心率

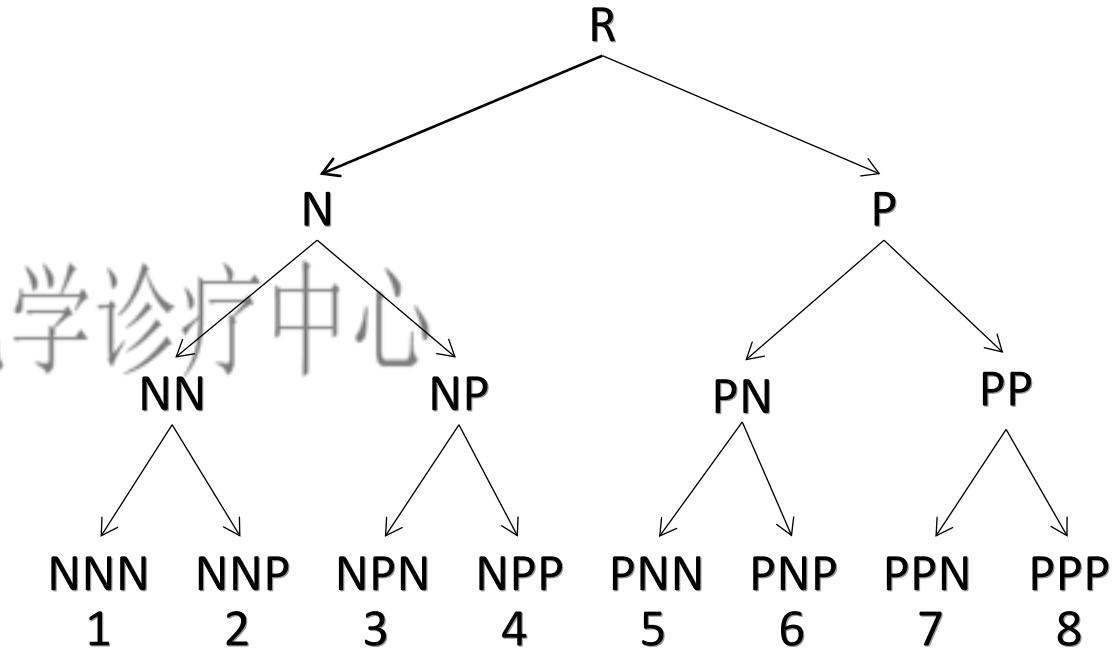
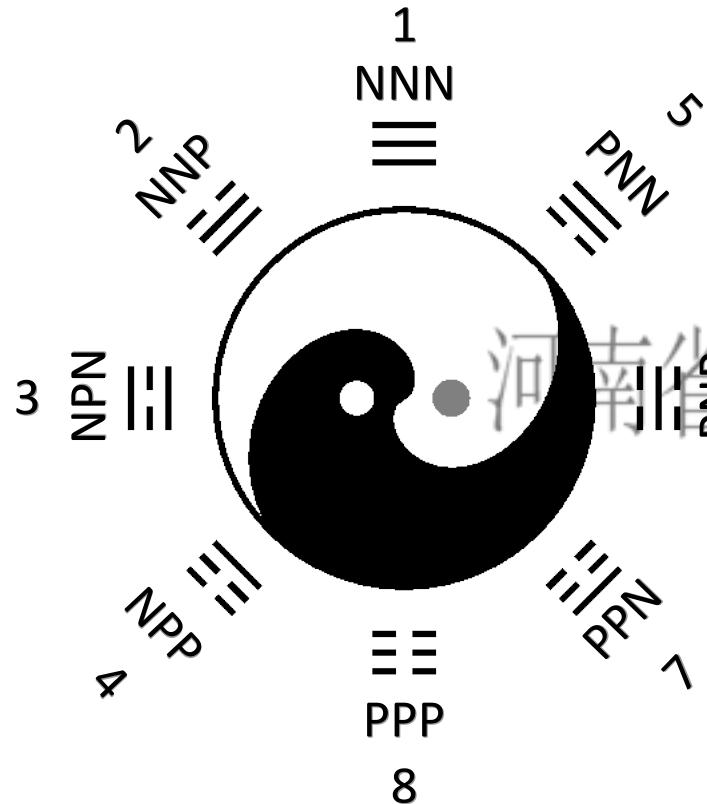


修正散点图 - 全部心率



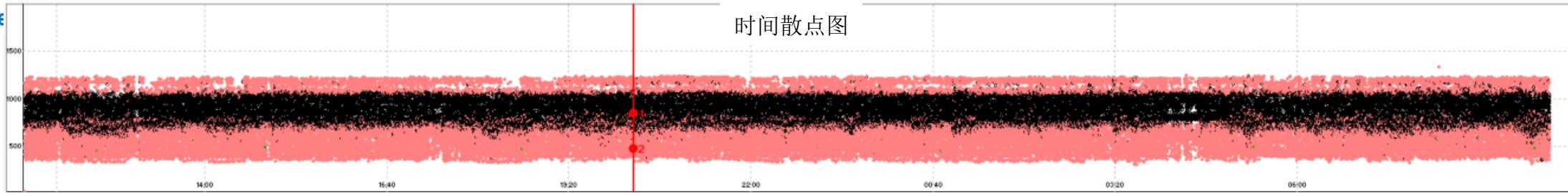


例2 并行心律的快速识别

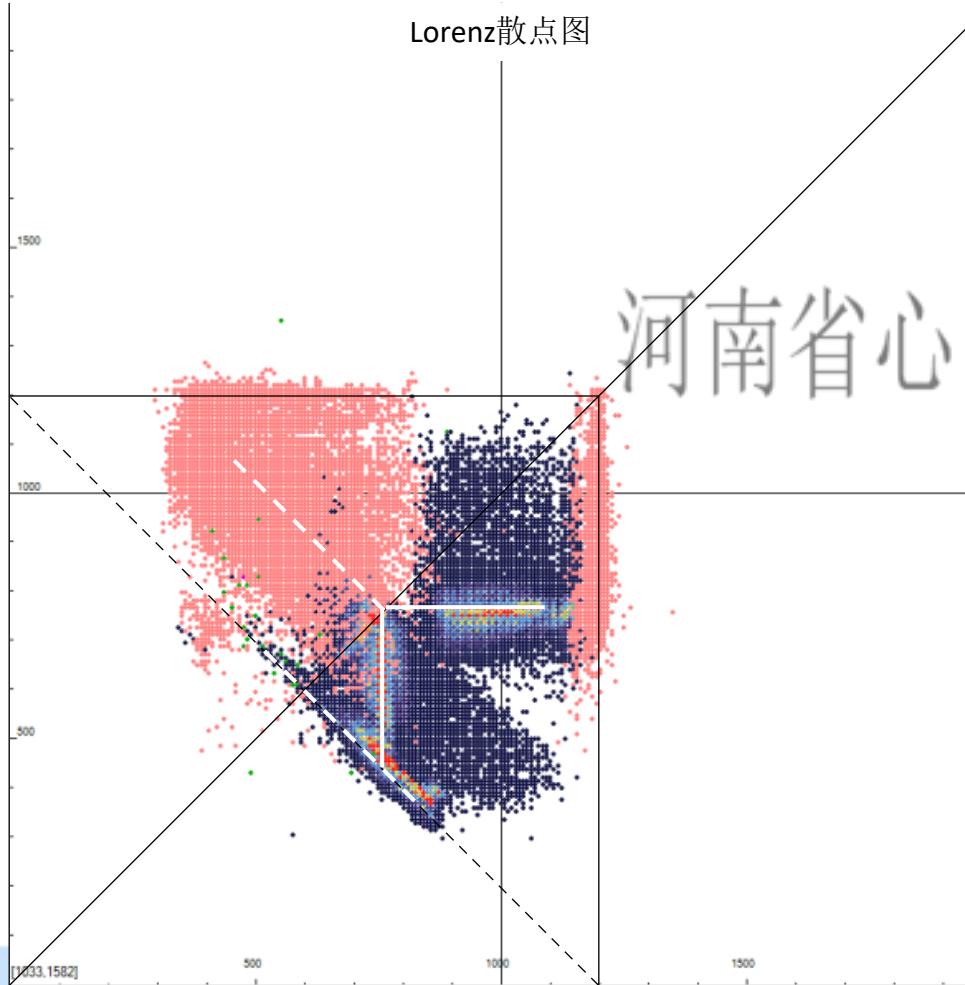




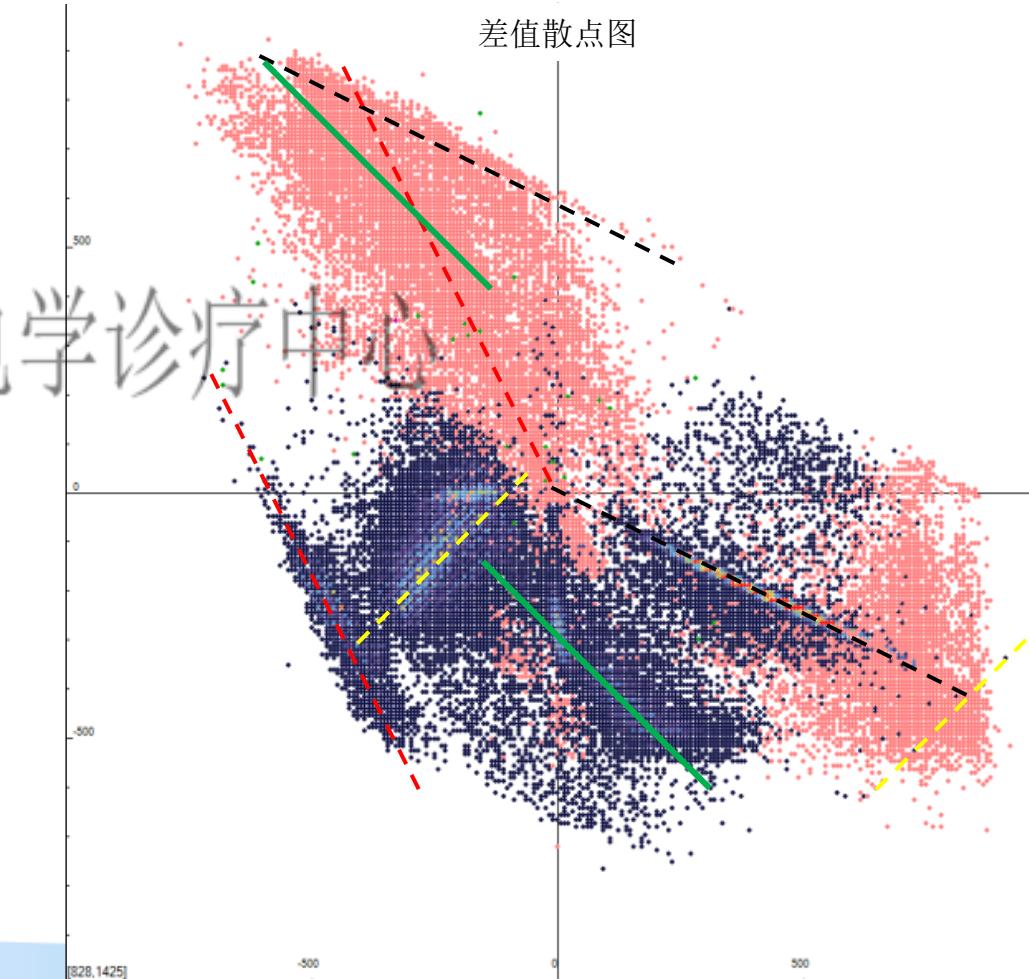
时间散点图



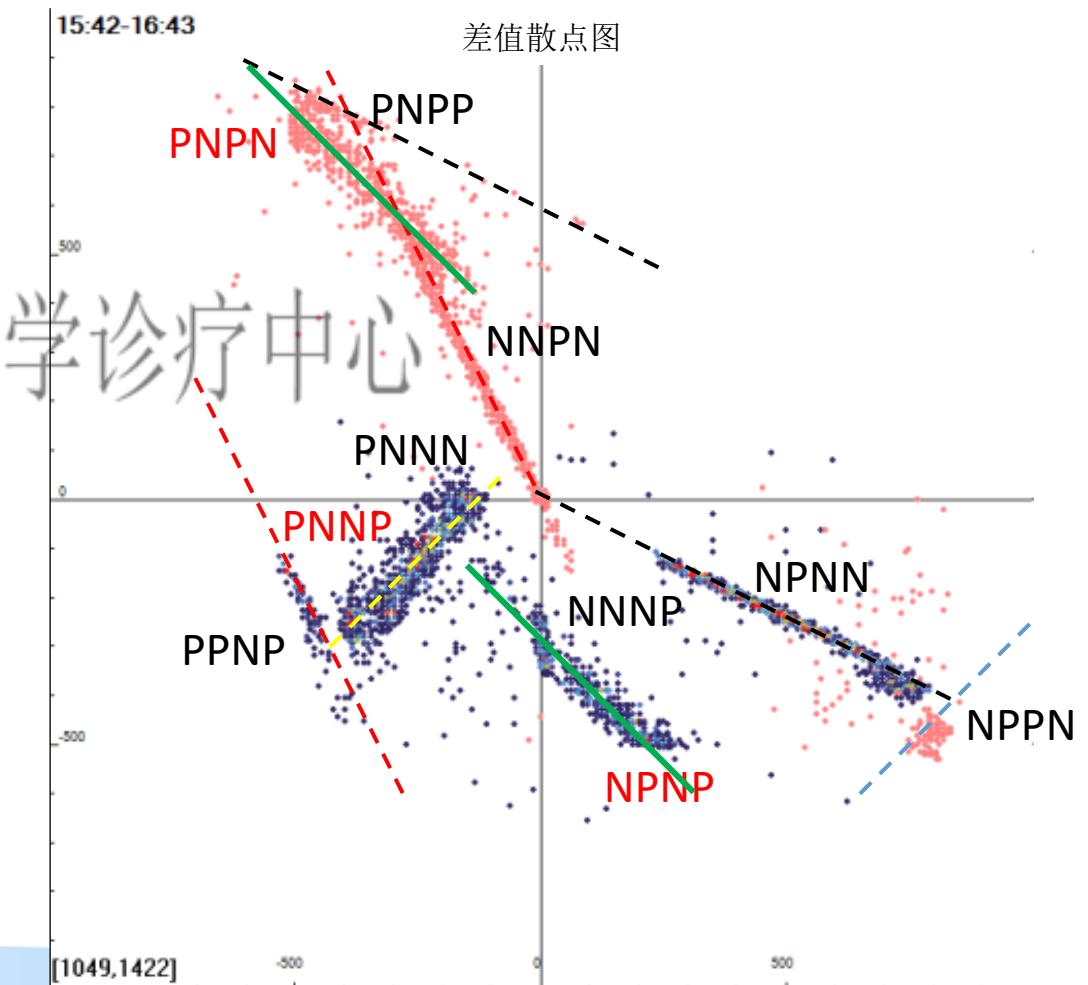
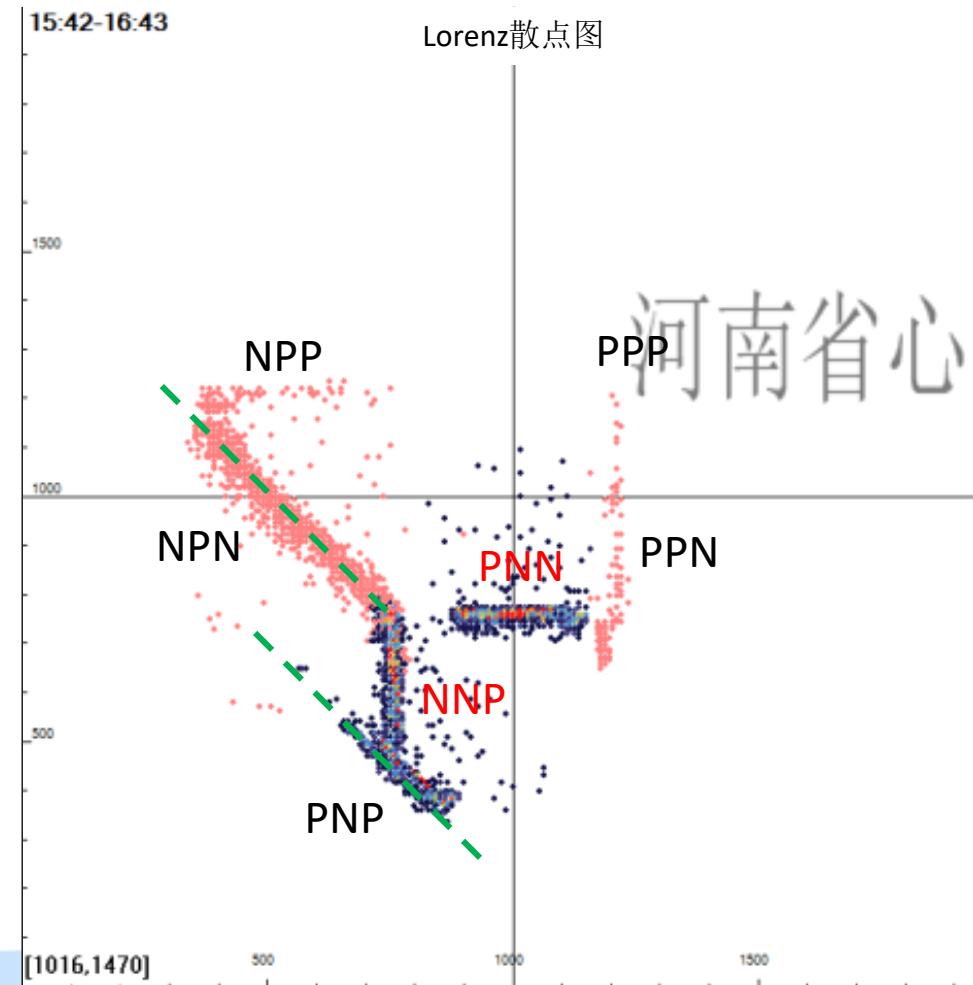
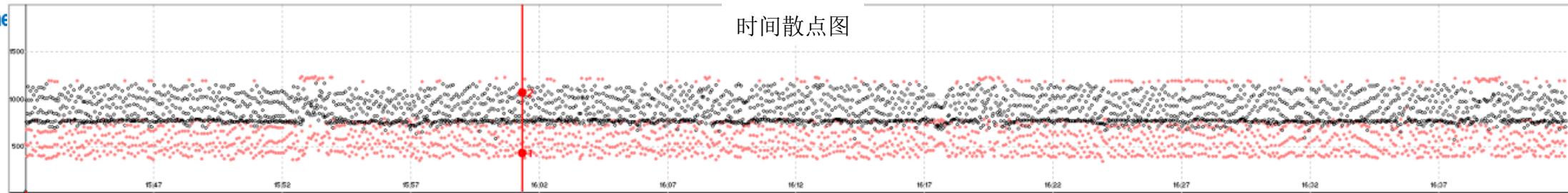
Lorenz 散点图



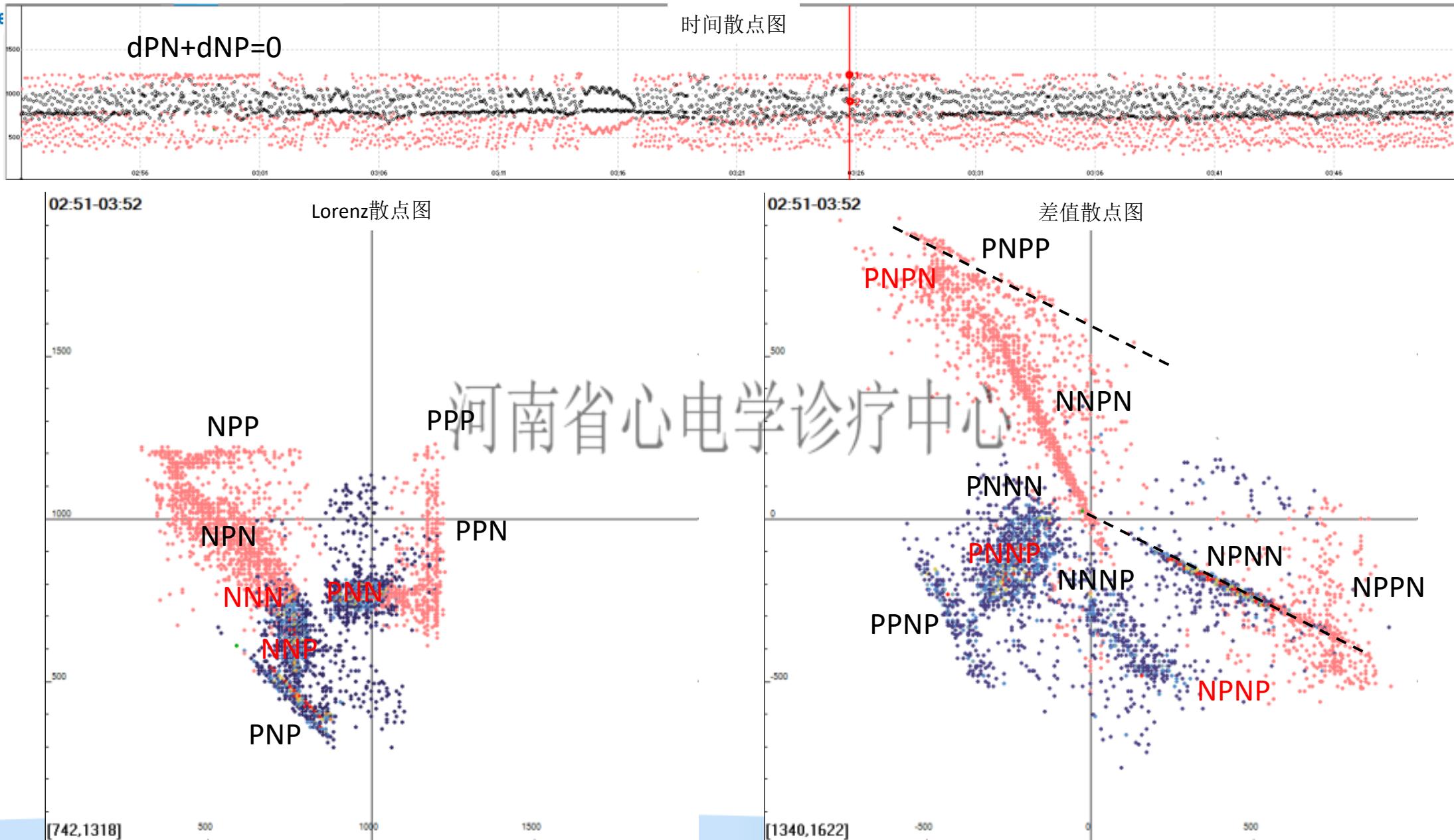
差值散点图

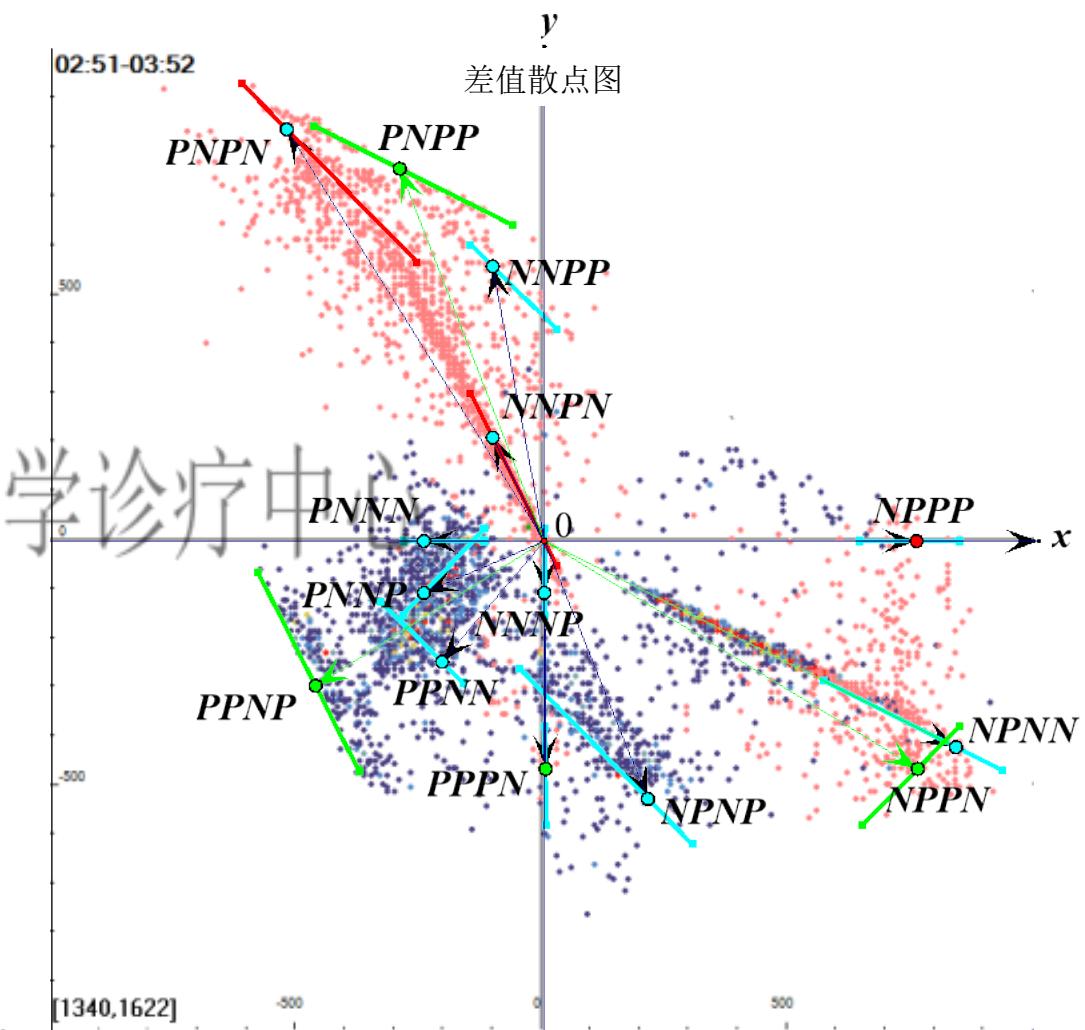
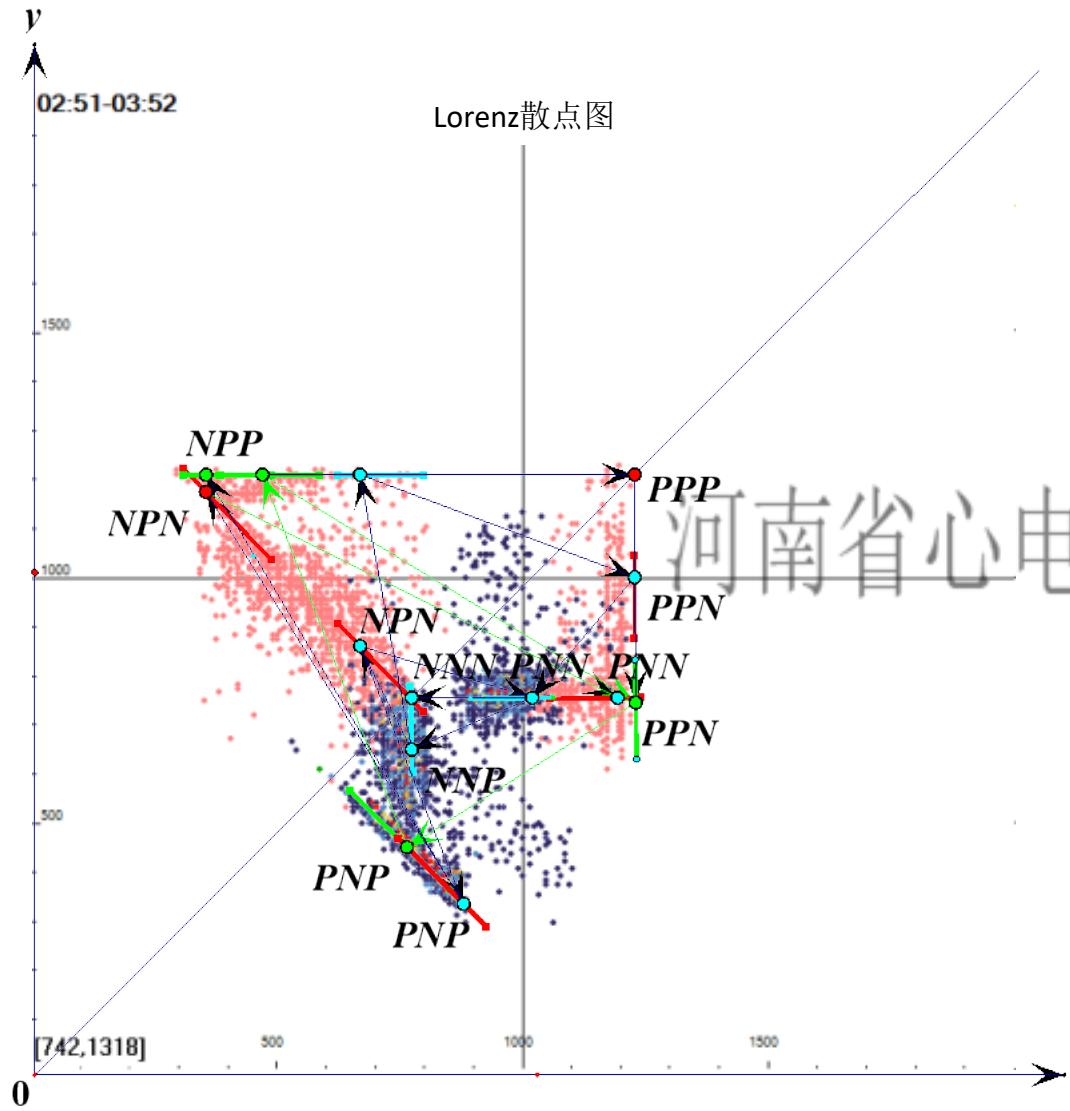


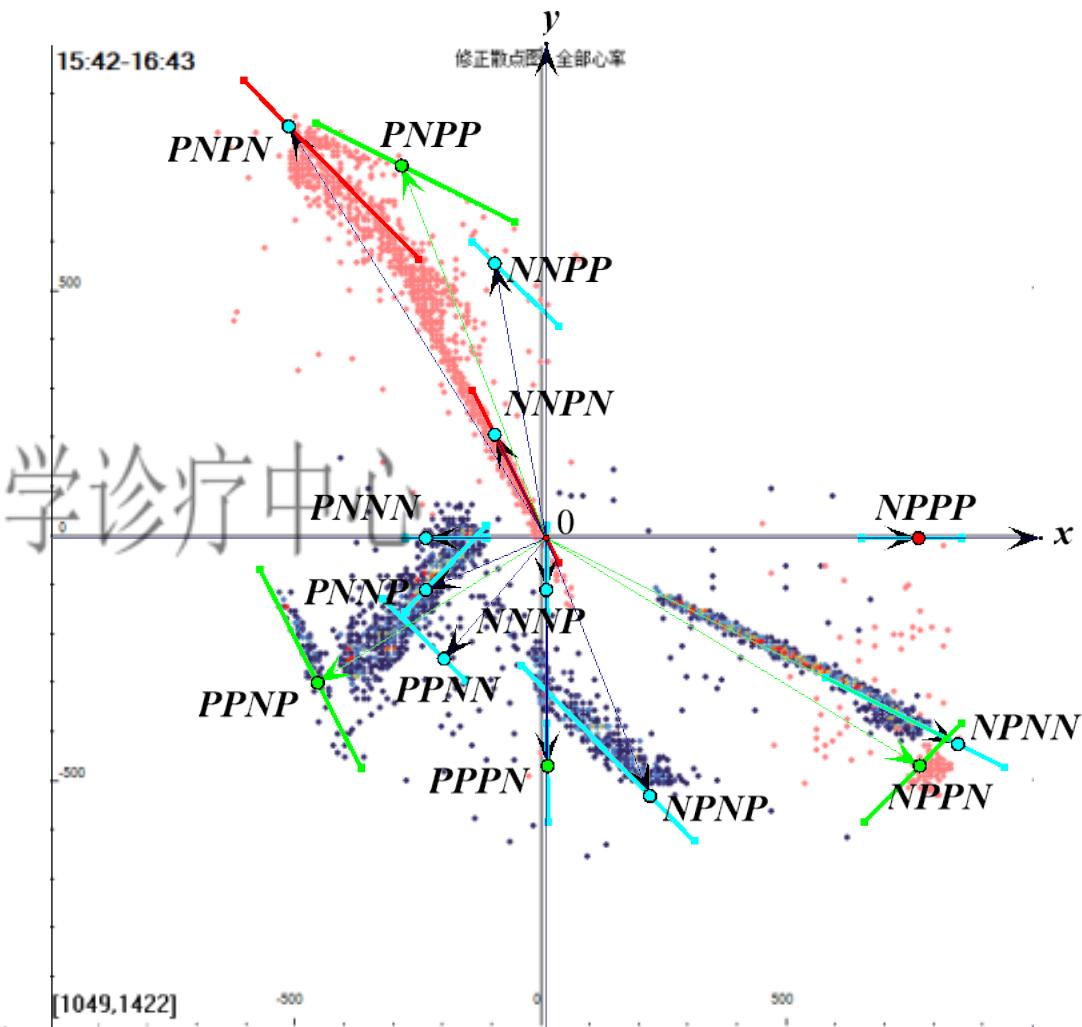
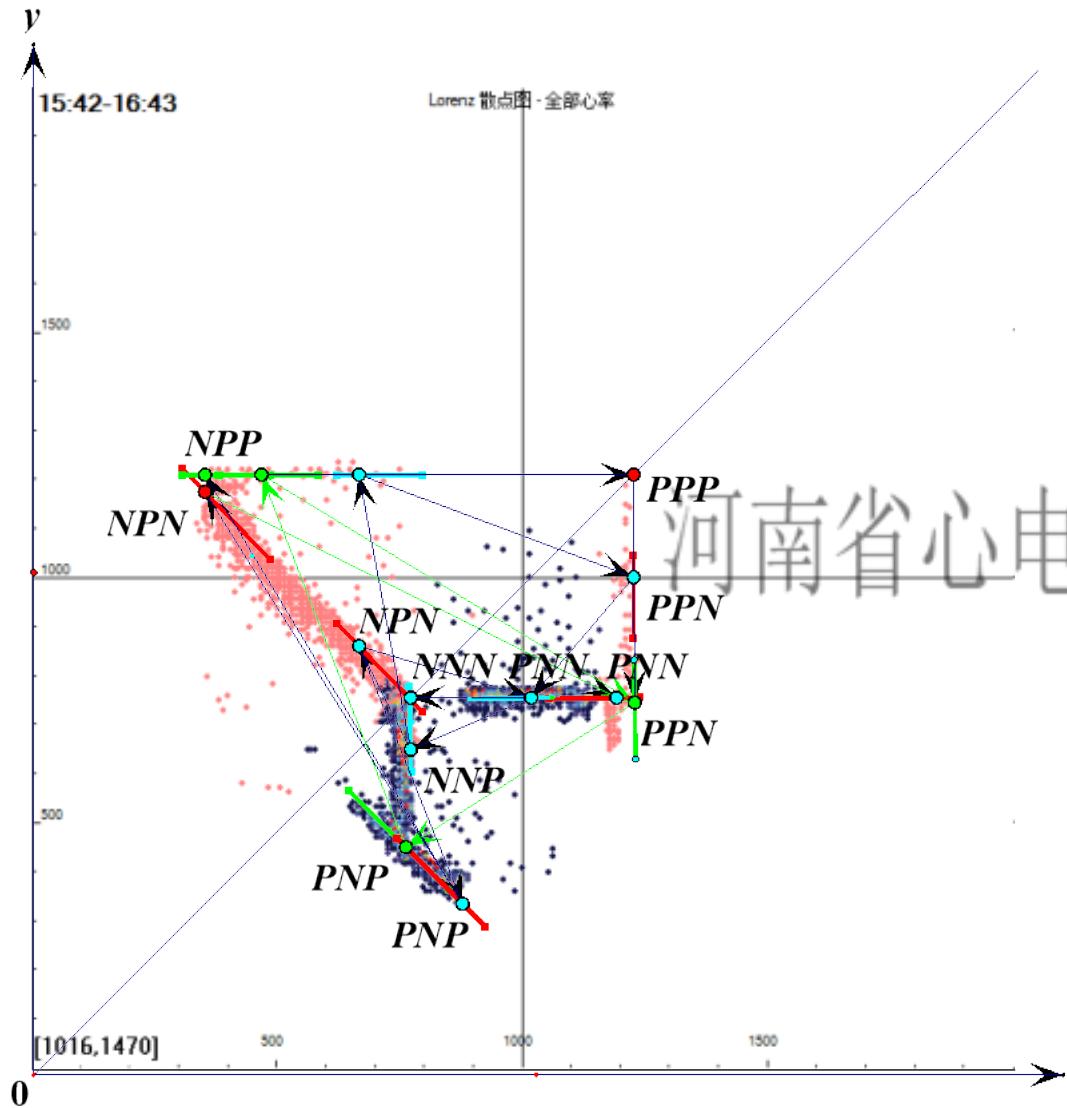
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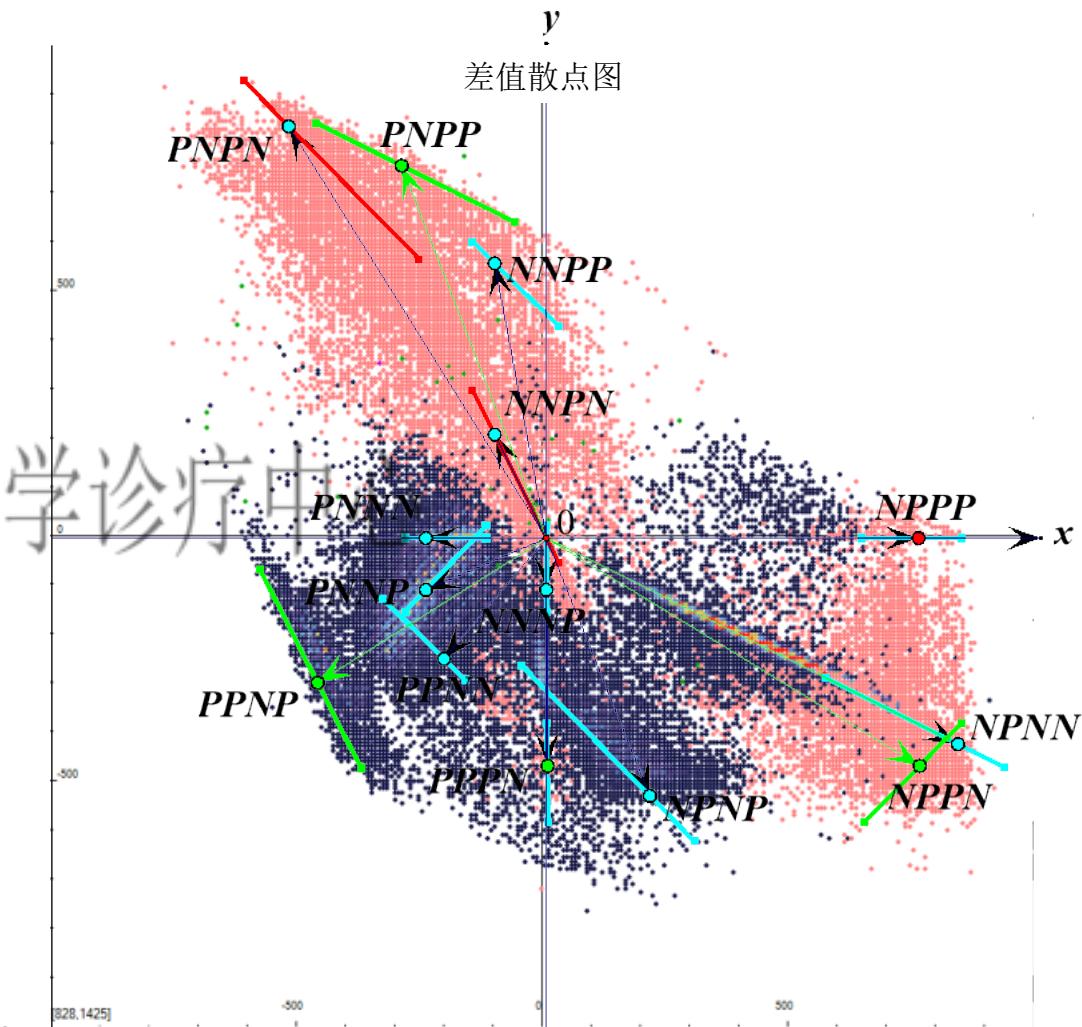
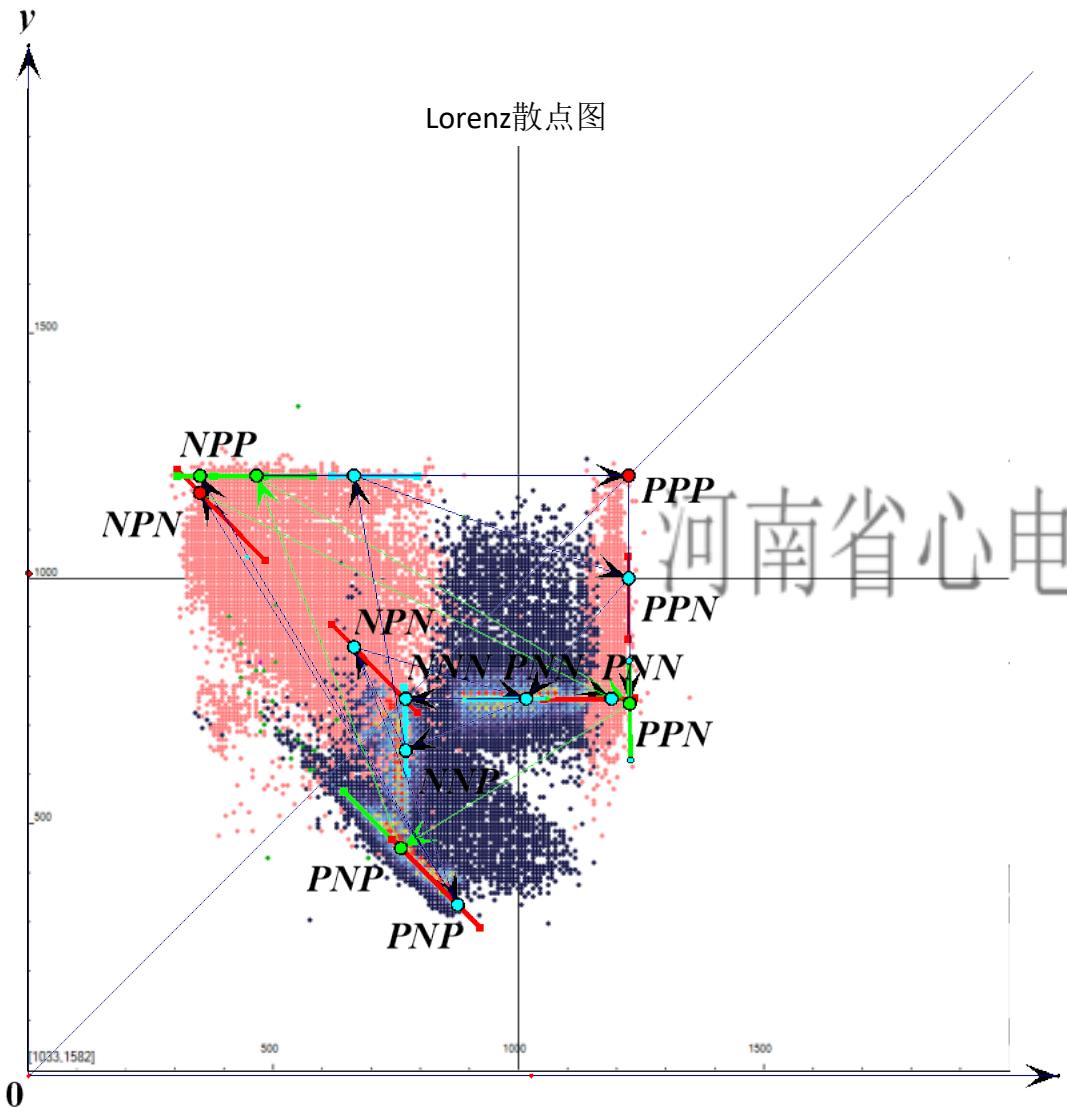


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周期性与随机性



NPNN PNNP NNPN NPNN PNNP NNPN NPNN
 $-\frac{1}{2}$ 1 $-\frac{1}{2}$ $-\frac{1}{2}$ 1 $-\frac{1}{2}$ -1

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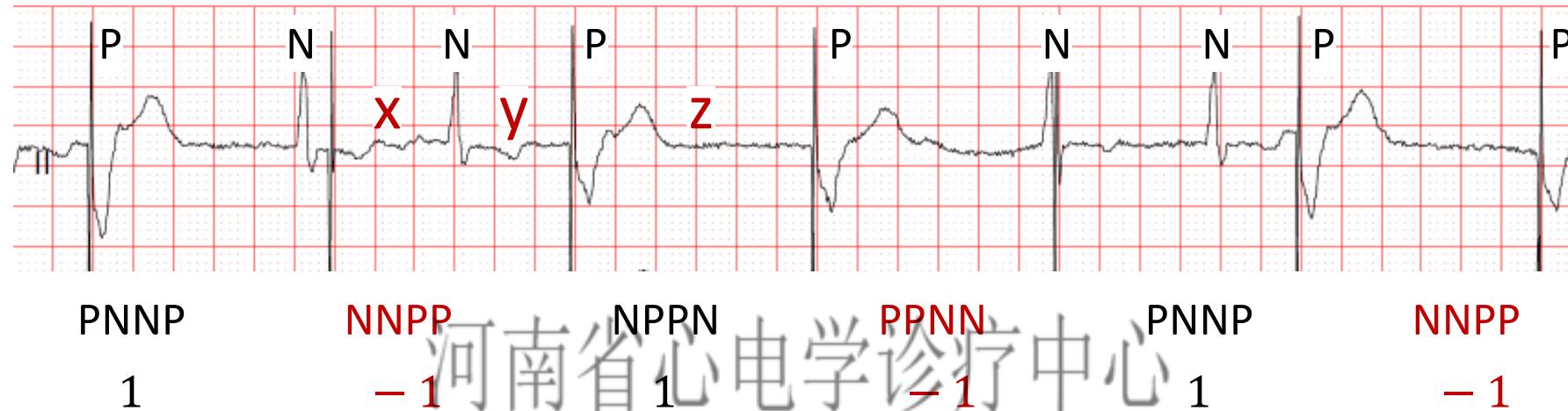
$$dx + dy = dy + dz = 0 \rightarrow dx = dz$$

$$k_{NPNP} = \frac{dz - dy}{dy - dx} = \frac{dx - dy}{dy - dx} = -1$$

两值守衡走实线
均值守衡走虚线



周期性与随机性



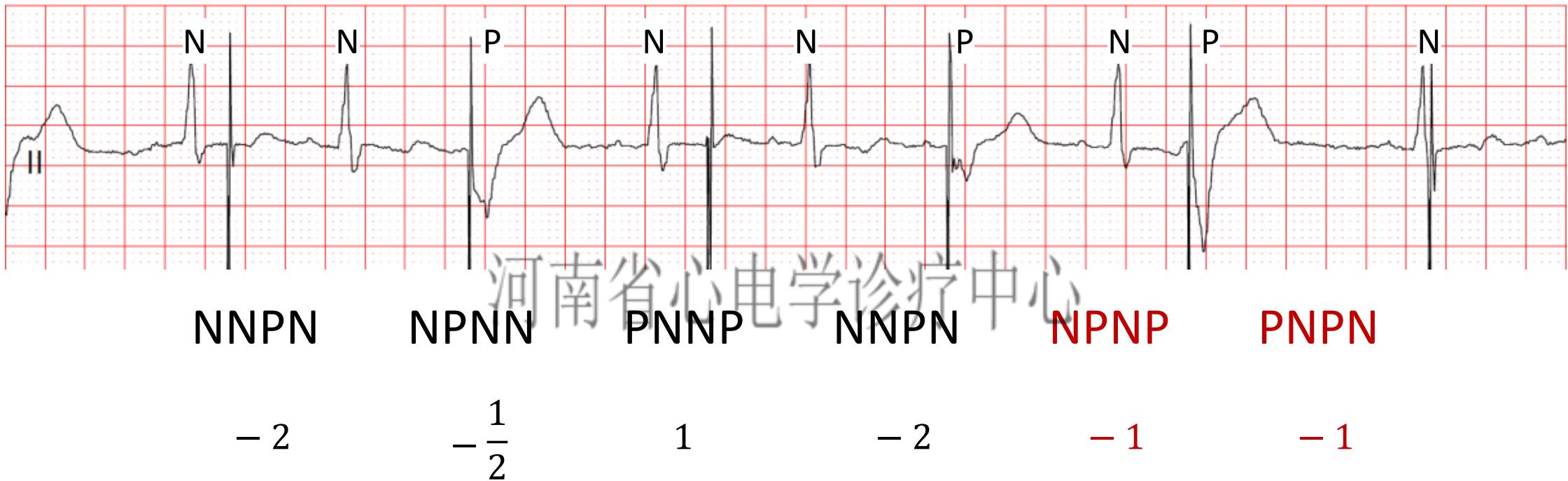
$$dx = dz = 0$$

$$k_{NNPP} = \frac{dz - dy}{dy - dx} = \frac{0 - dy}{dy - 0} = -1$$

两值守衡走实线
均值守衡走虚线

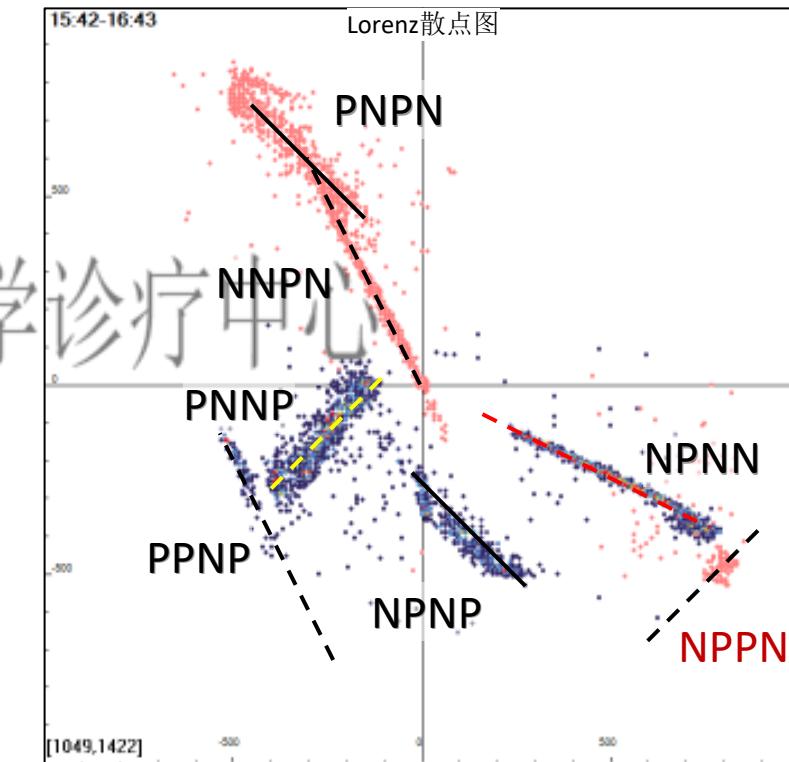
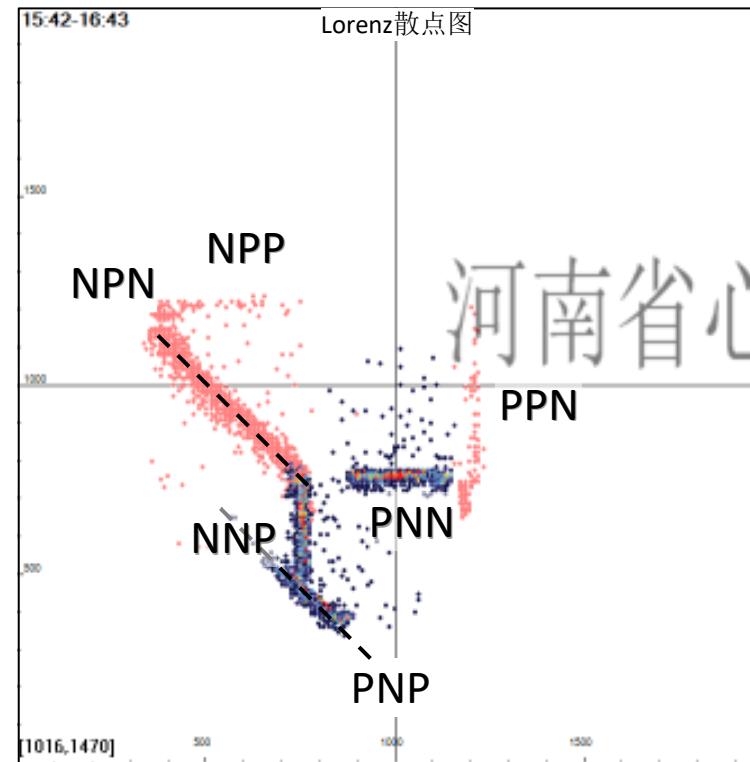


周期性与随机性





分时散点图（起搏性早搏二、三联律）

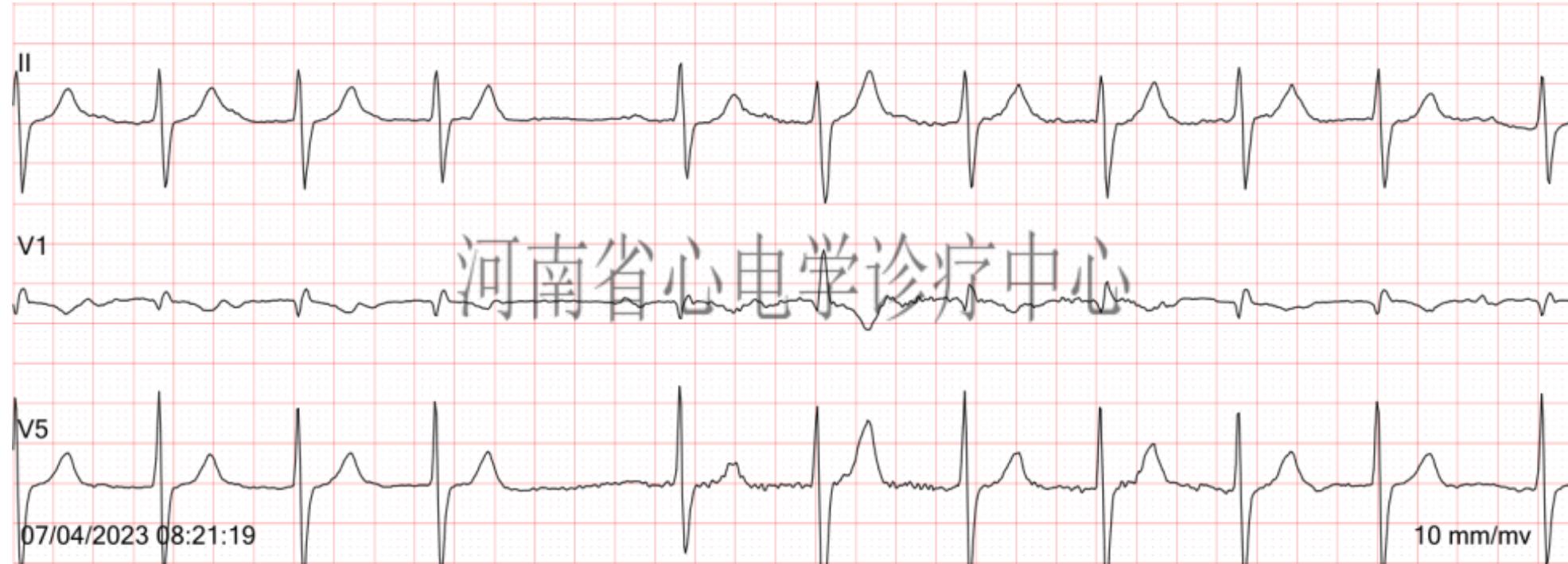


启示

- RR间期大小对比与恒变性质决定着散点集落的位置及走向。
- 并行心律性早搏的联律间期与代偿间期是**随机性**变量，而主导心律与附加心律的RR间期是**周期性**变量，随机性变量的变异性远大周期性变量的变异性，当二者相遇时，可以认为周期性变量为恒量。
- 等速线上分布有高低不一、变异性不同的两个节律点，等速线两边散点代表两个节律交替的频次。
- 阴阳互补的散点集落相互平行
- 竞争性起搏心律相当于人工并行心律，了解人工并行心律的规律性，有利于掌握天然并行心律的规律性。



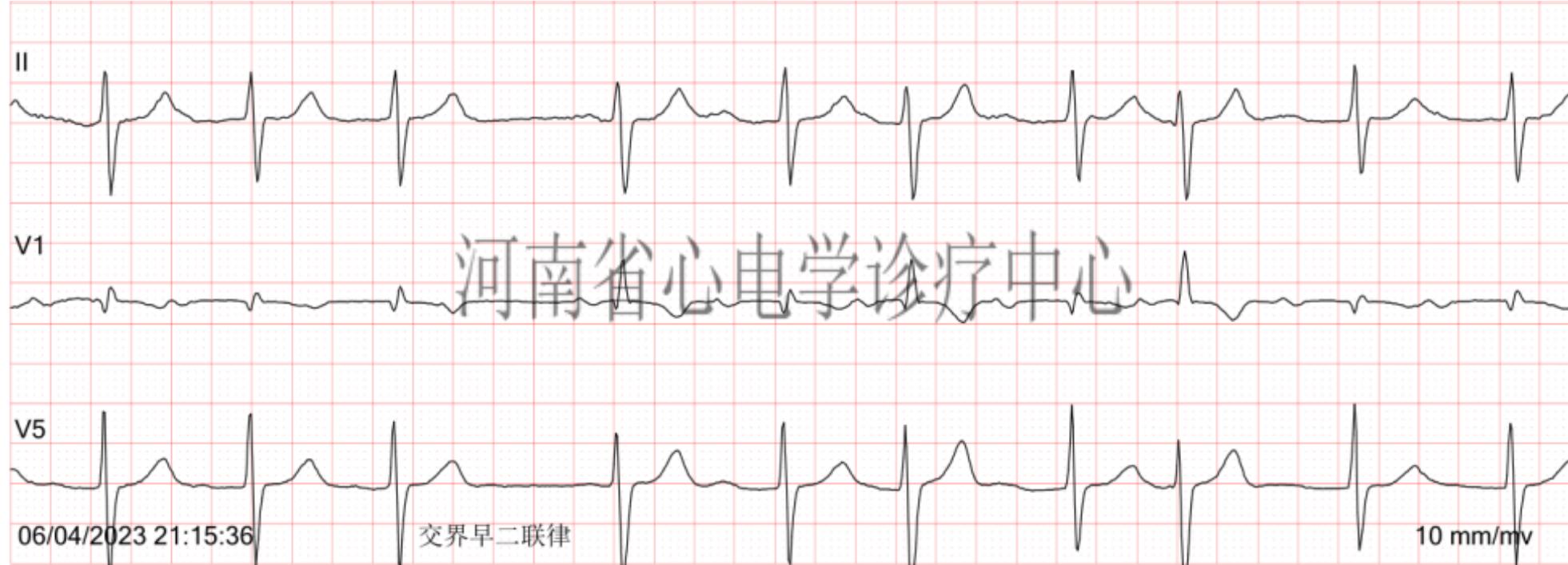
例3 疑难、复杂病例的快速识别



动态心电图片段



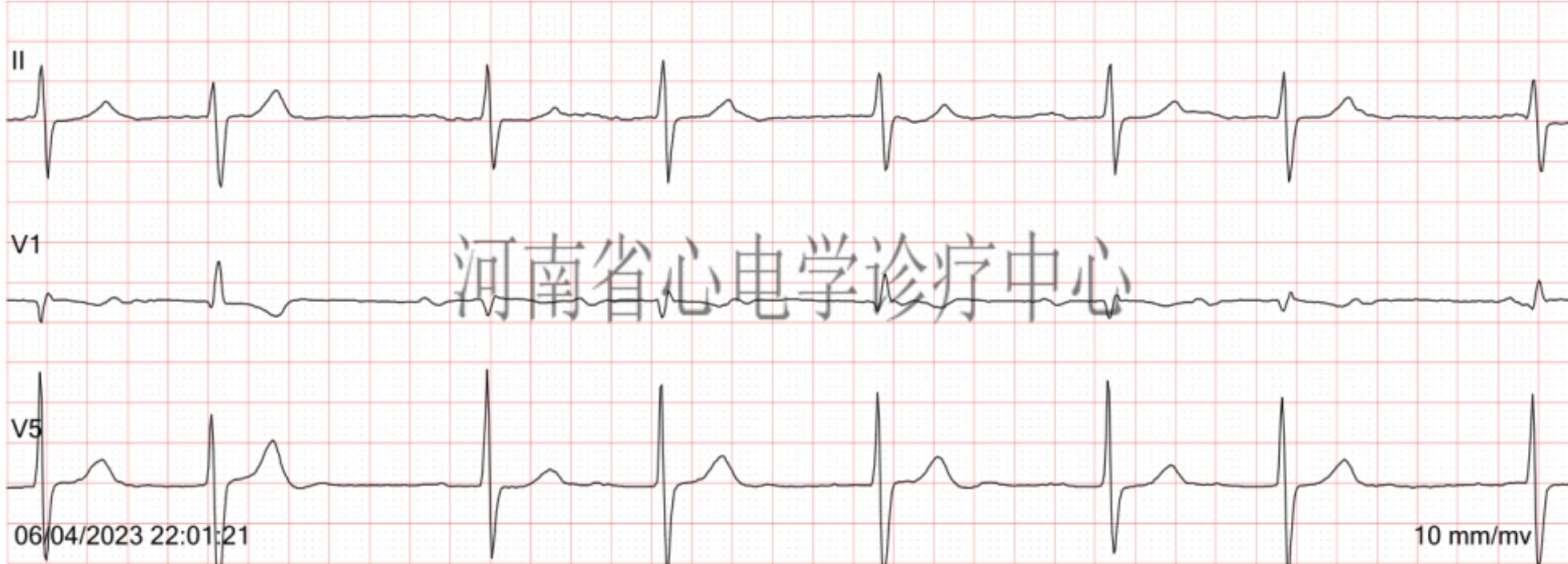
例3 复杂、疑难病例的快速识分析



动态心电图片段



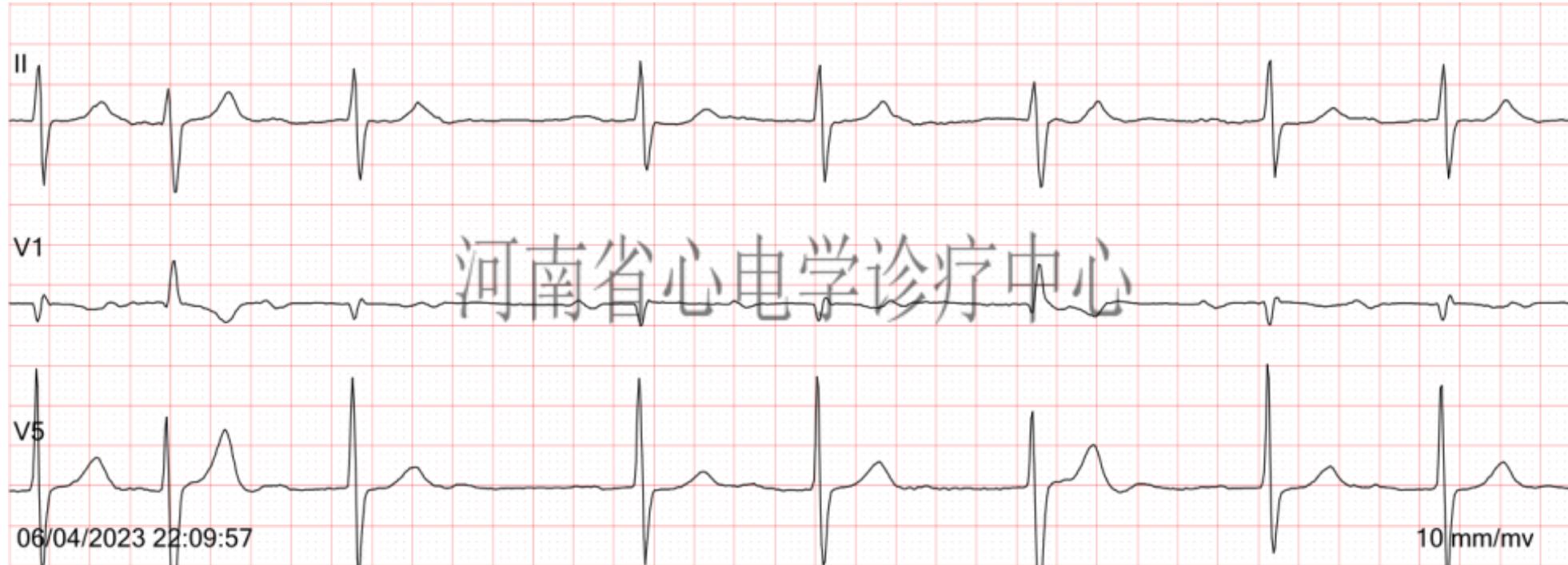
例3 复杂、疑难病例的快速识分析



动态心电图片段



例3 复杂、疑难病例的快速识分析



动态心电图片段



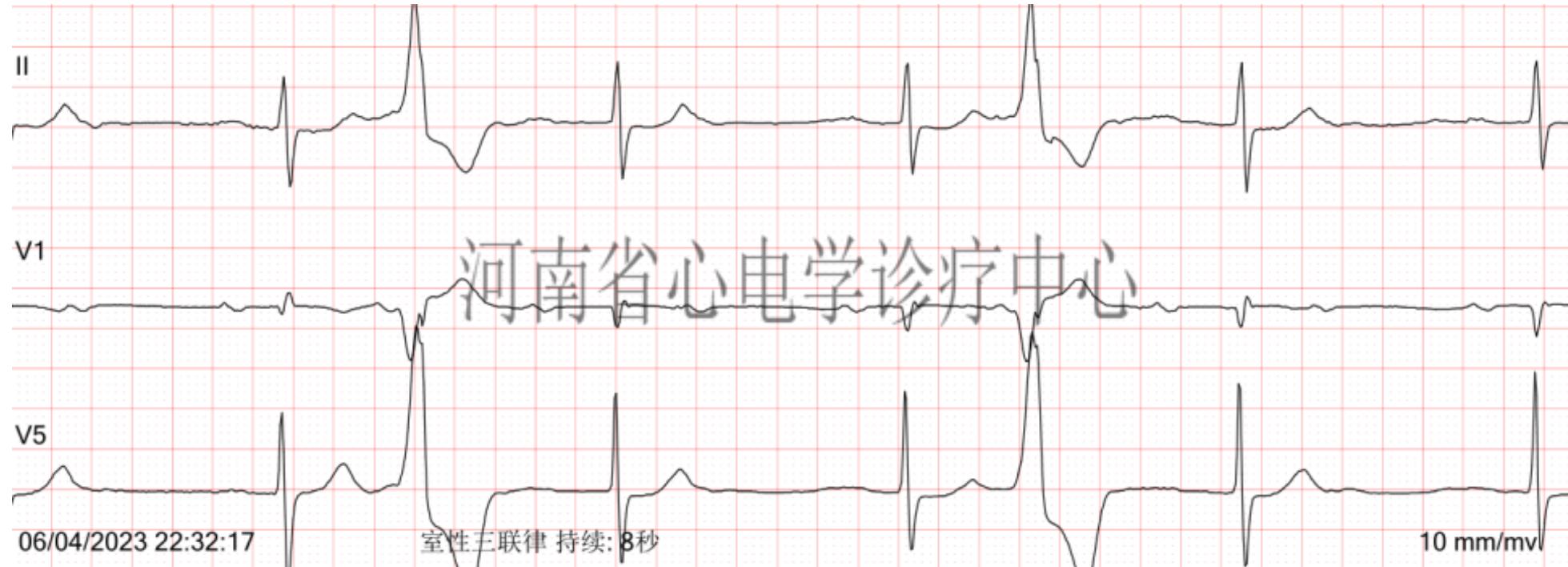
例3 复杂、疑难病例的快速识分析



动态心电图片段

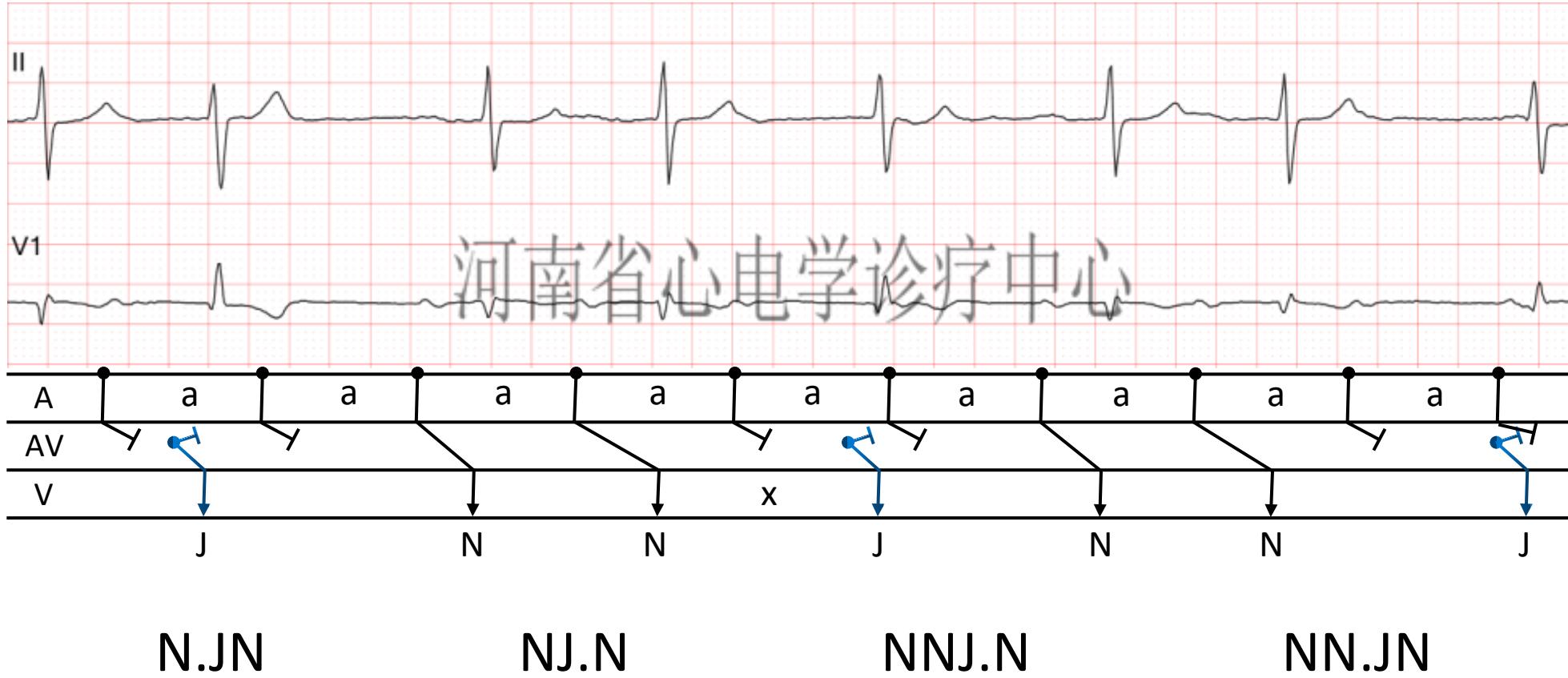


例3 复杂、疑难病例的快速识分析



动态心电图片段

例3 复杂、疑难病例的快速识分析

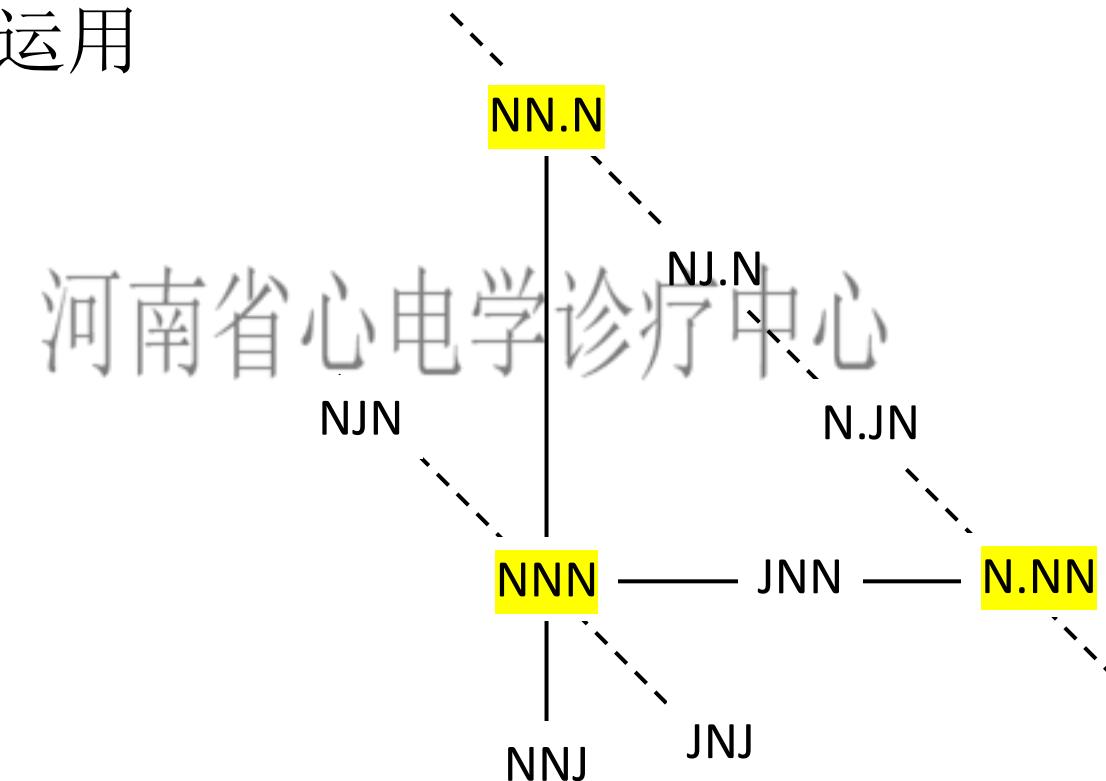




Lorenz散点图各特征点集内在联系

重要标识线的运用

恒变上下移
变恒左右行
两变织彩虹
两恒结成星



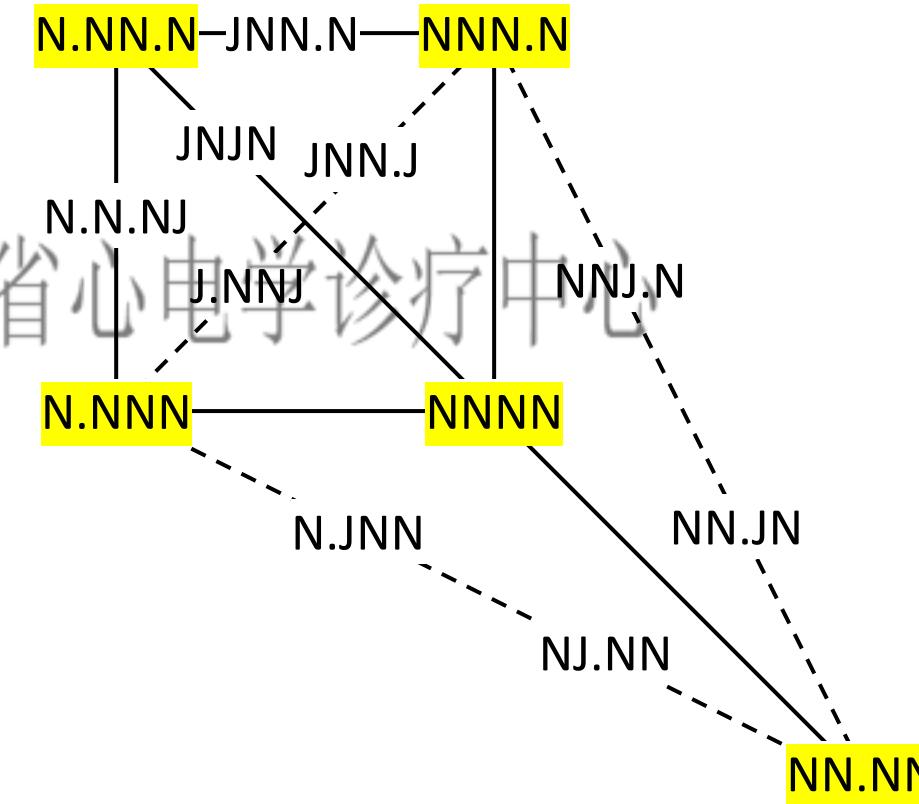


差值散点图各特征点集内在联系

重要标识线的运用

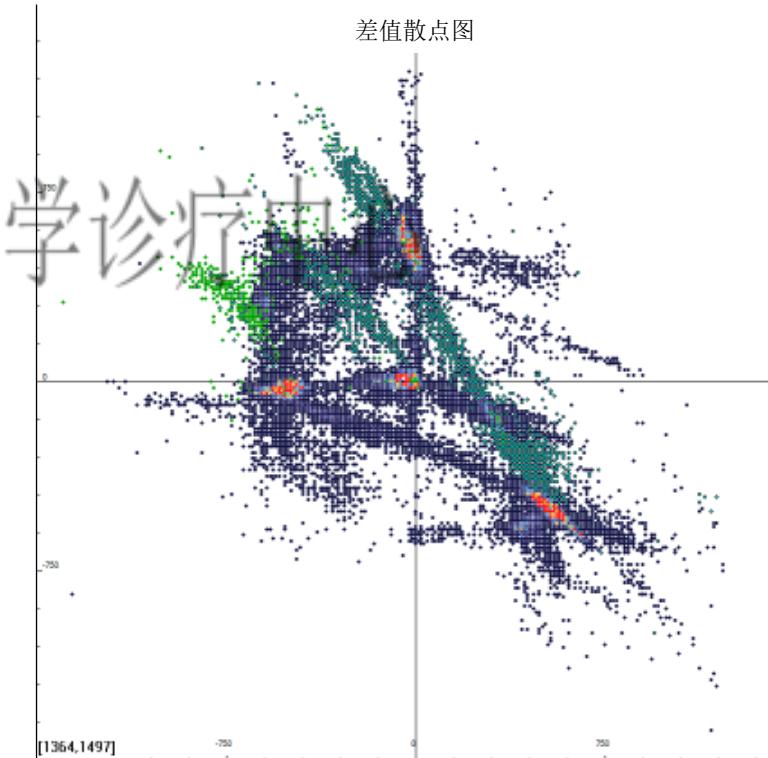
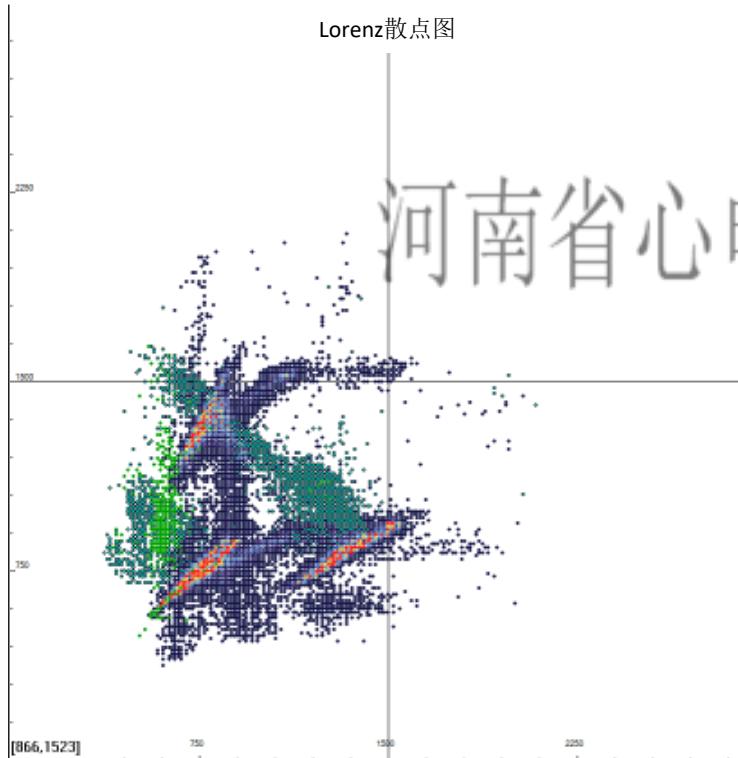
两值守恒走实线
均值守恒走虚线

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全程心电散点图

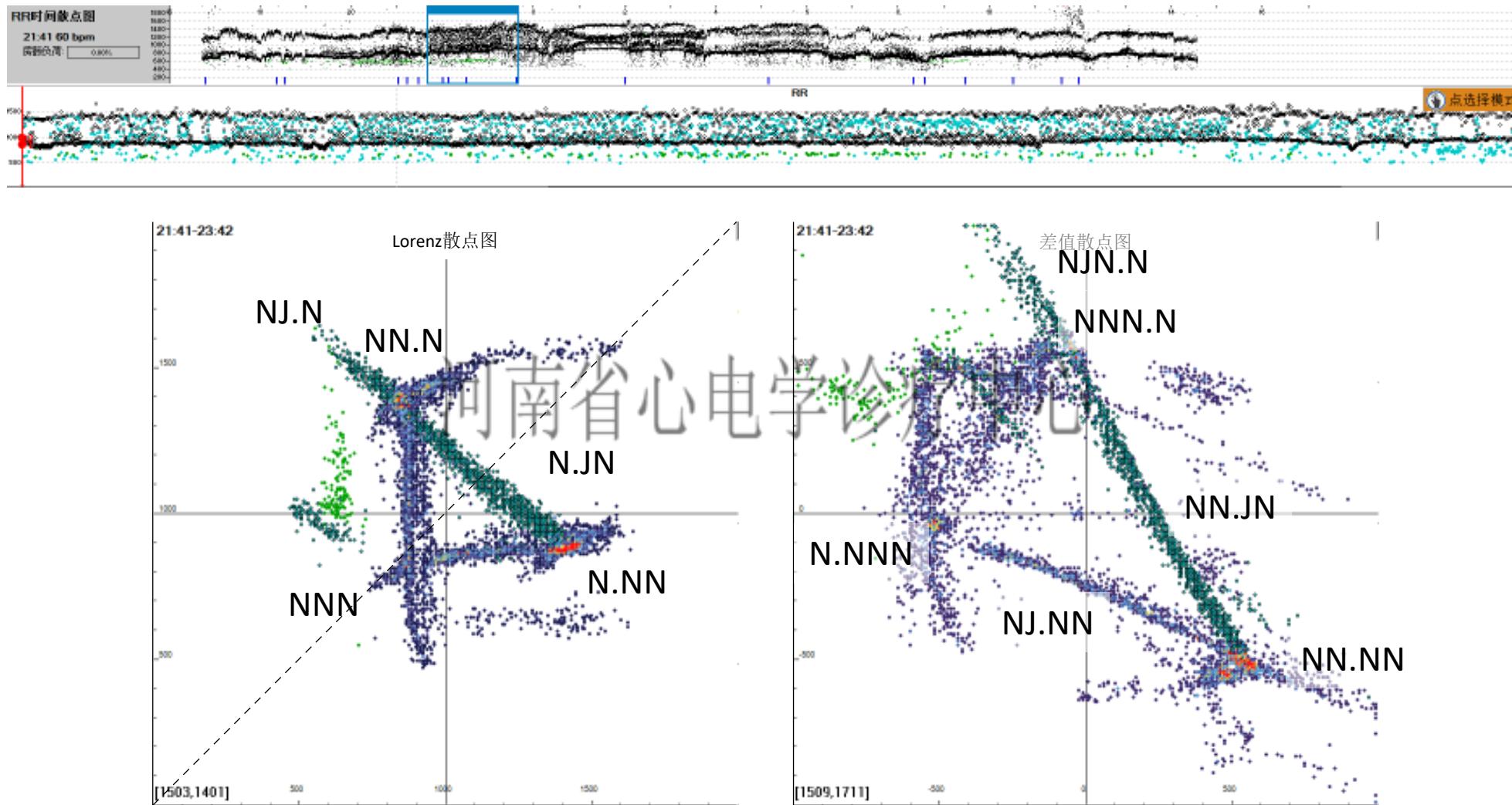




郑州大学第二附属医院

The Second Affiliated Hospital of ZJU

2小时

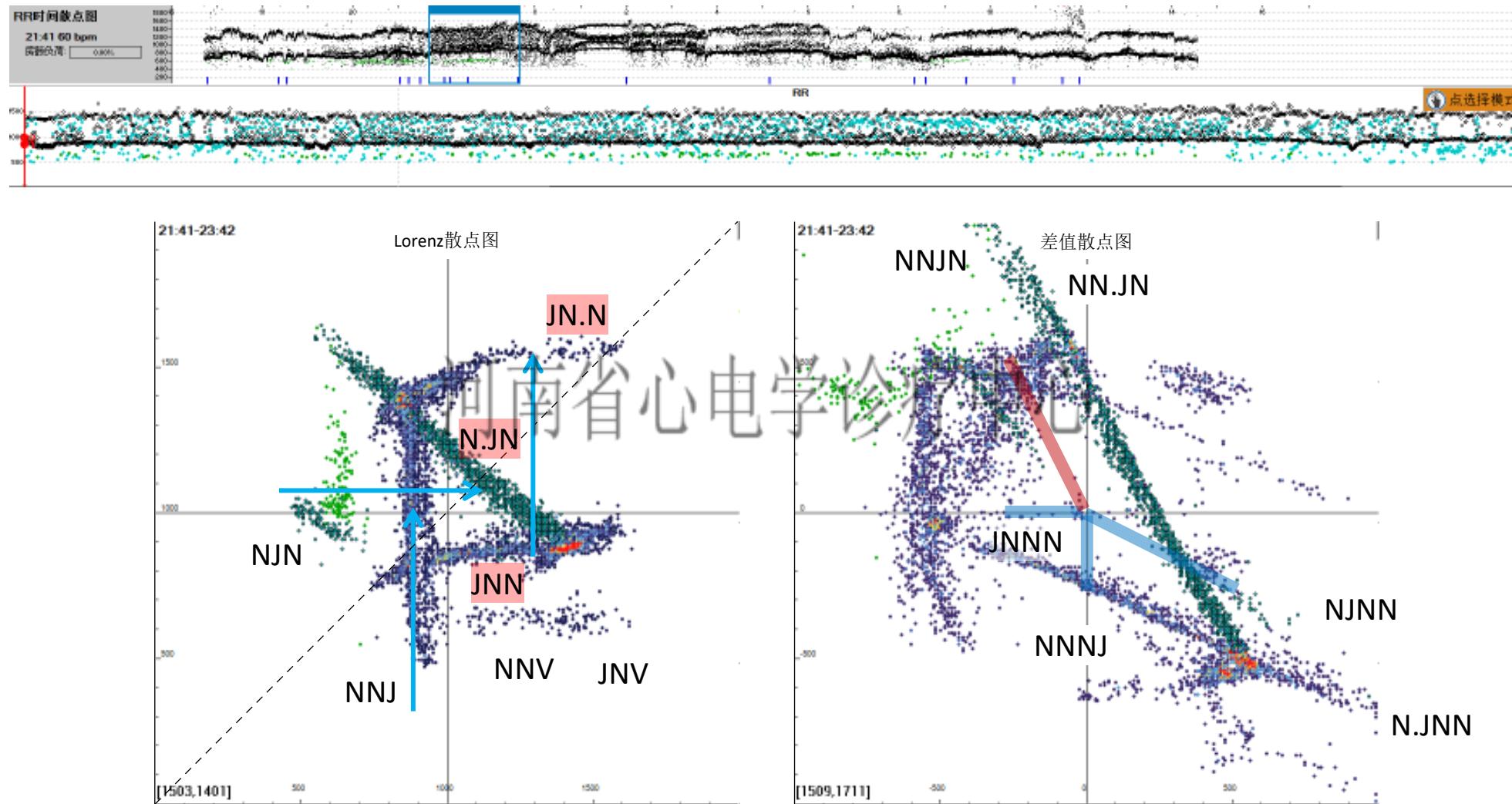




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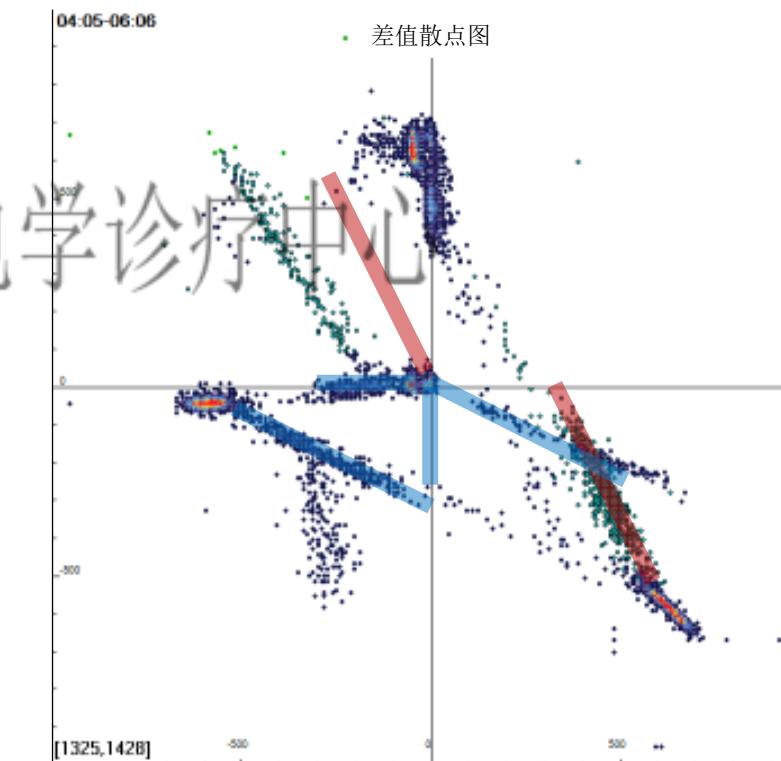
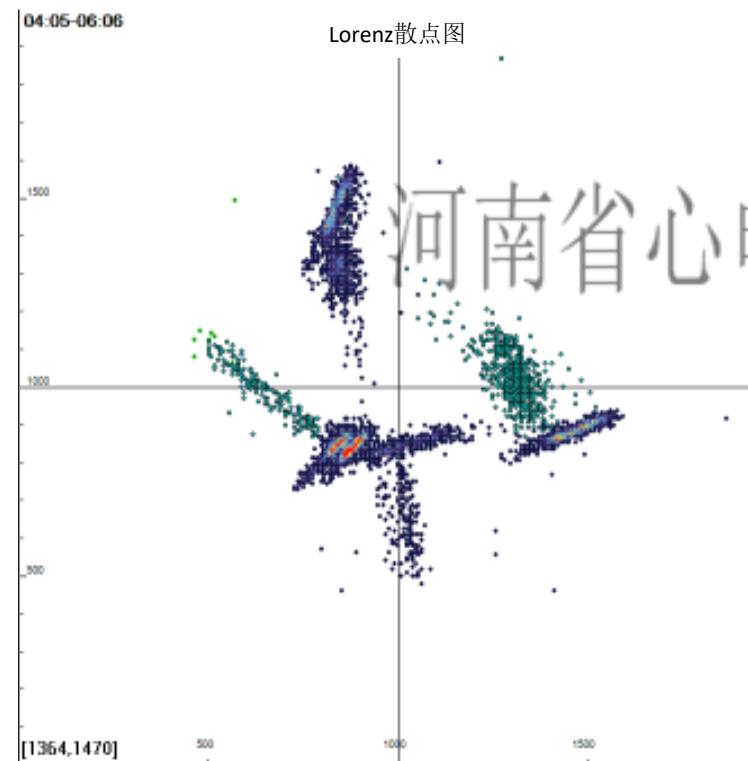
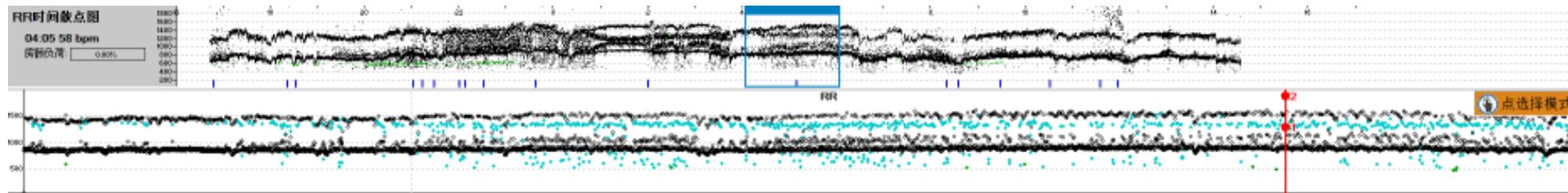




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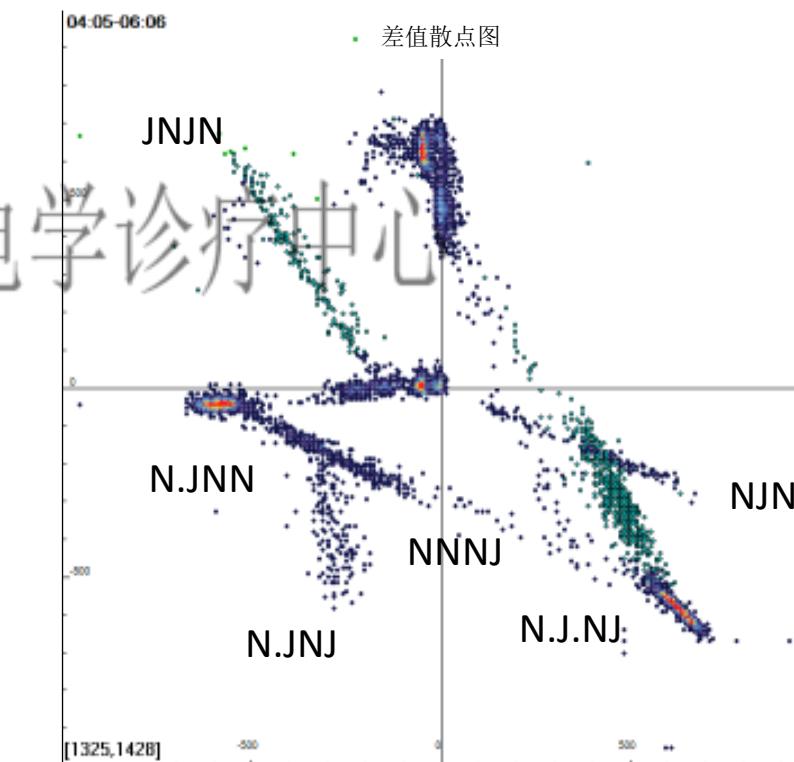
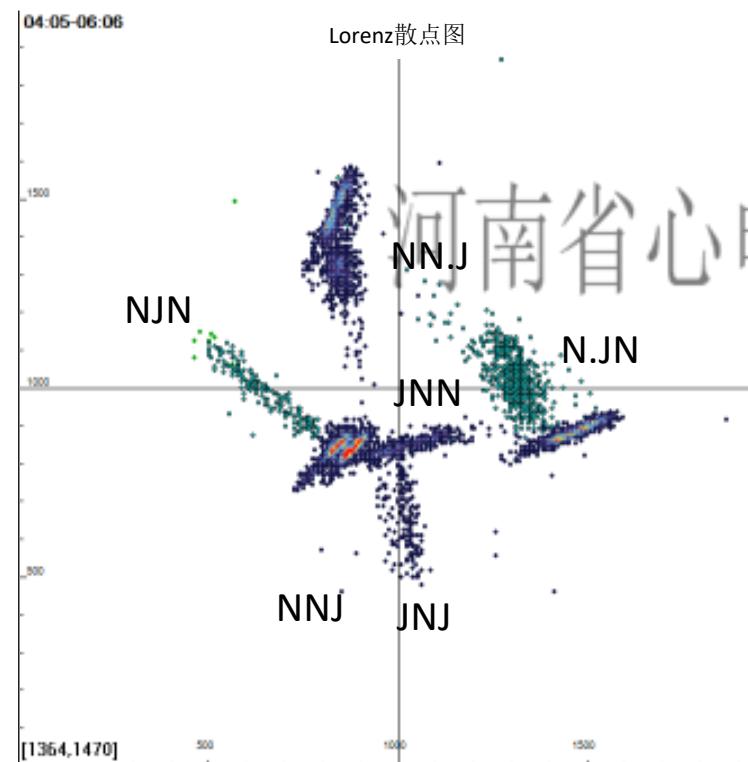
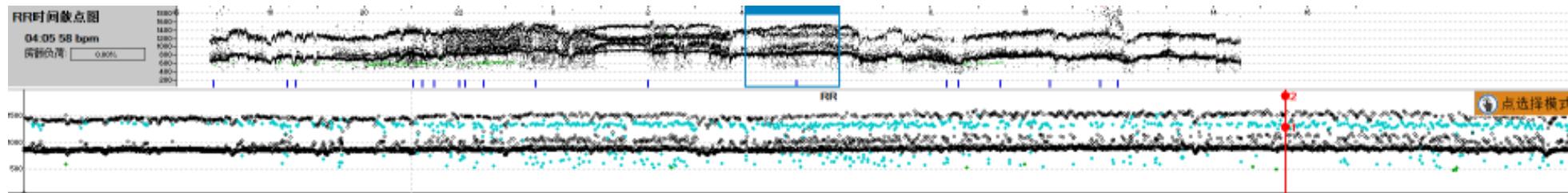
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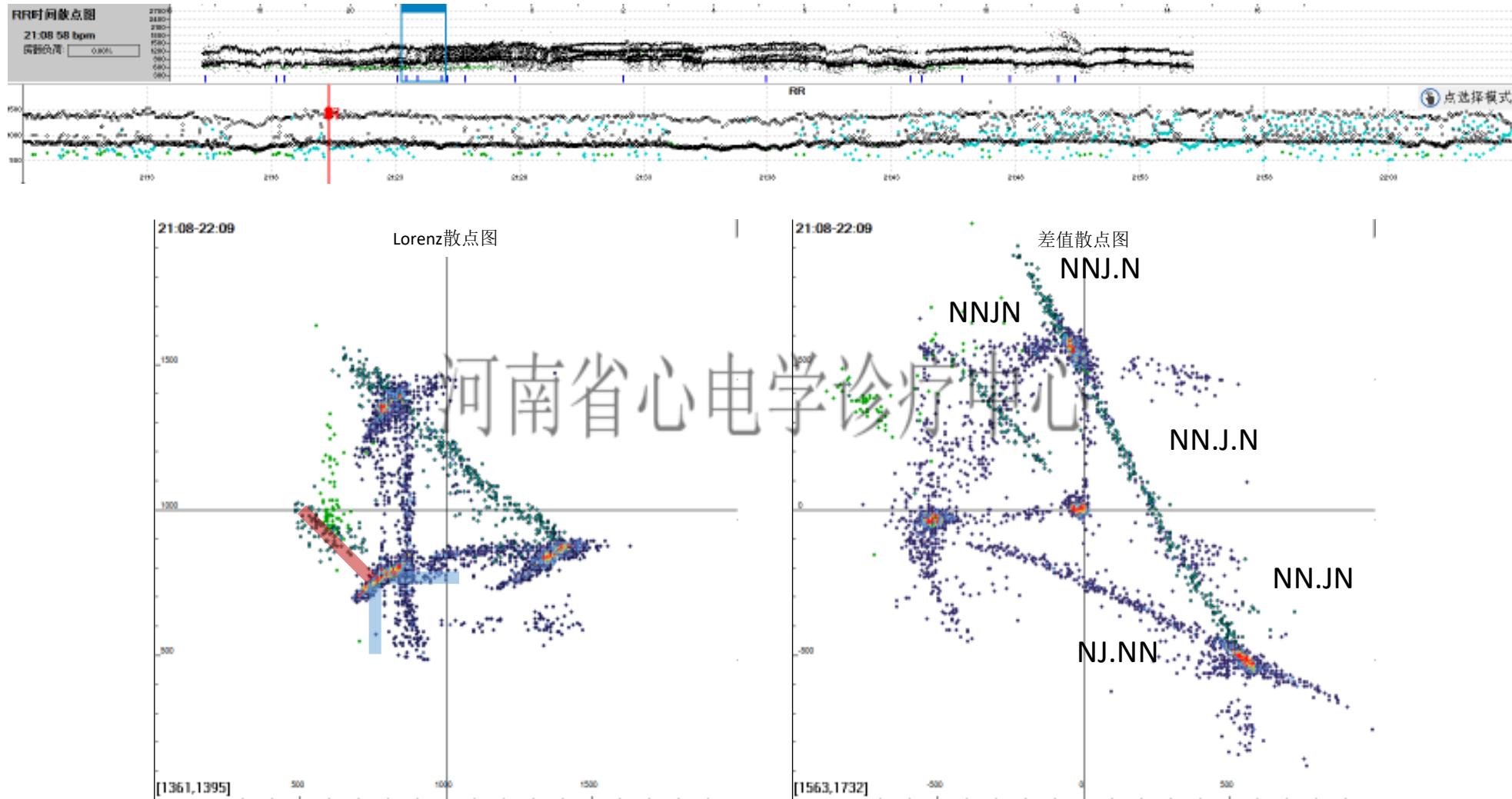




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1小时

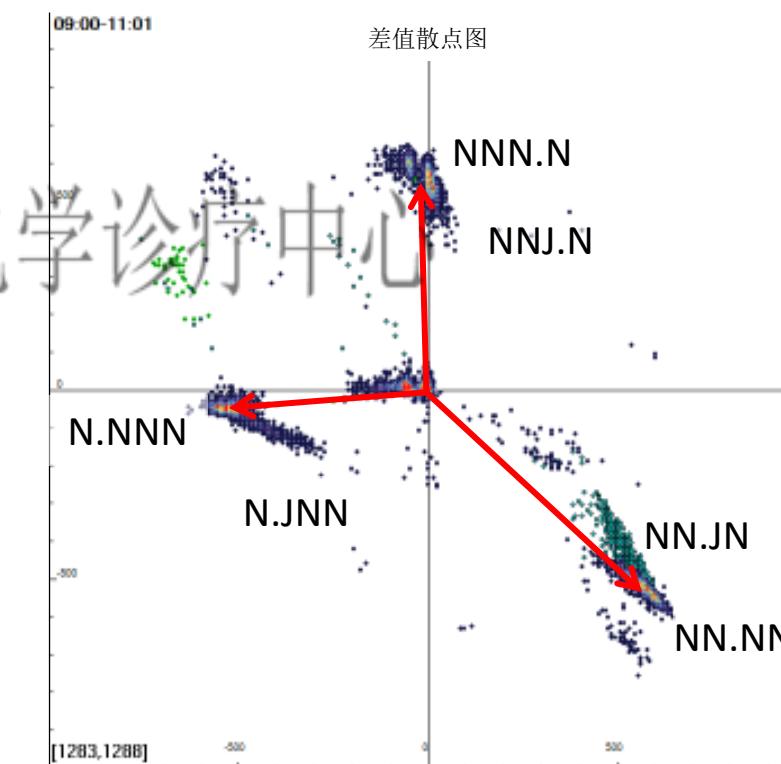
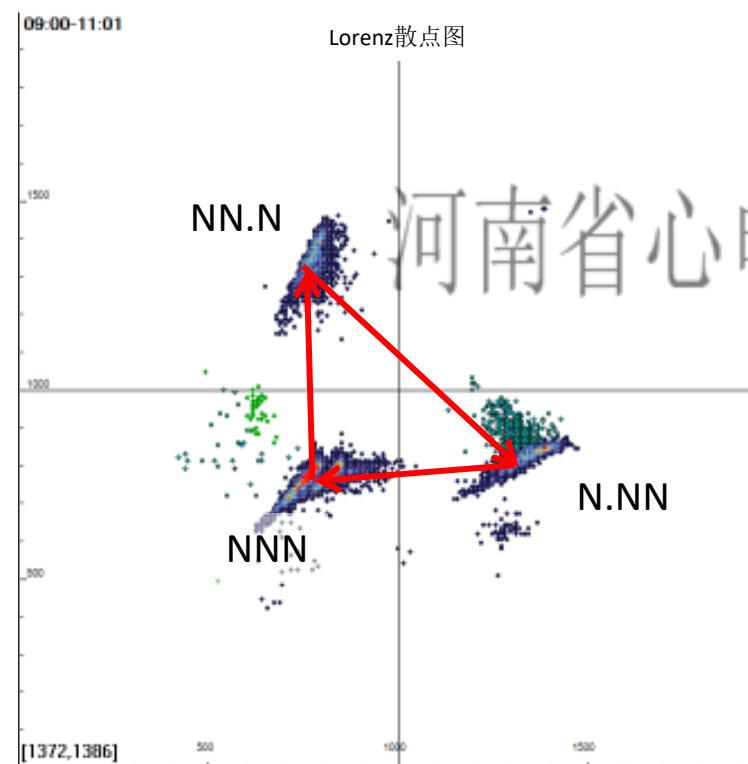
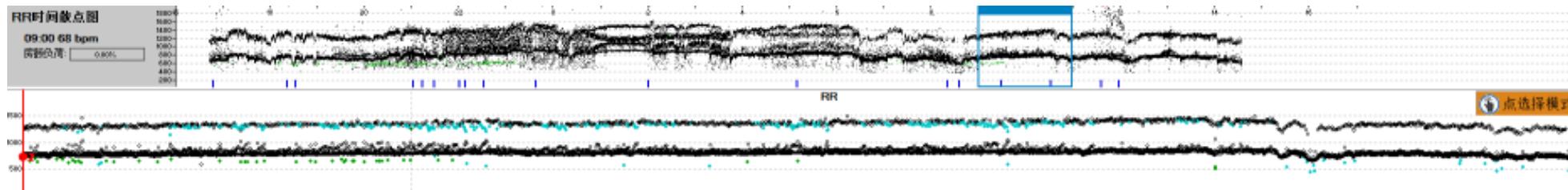




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2小时



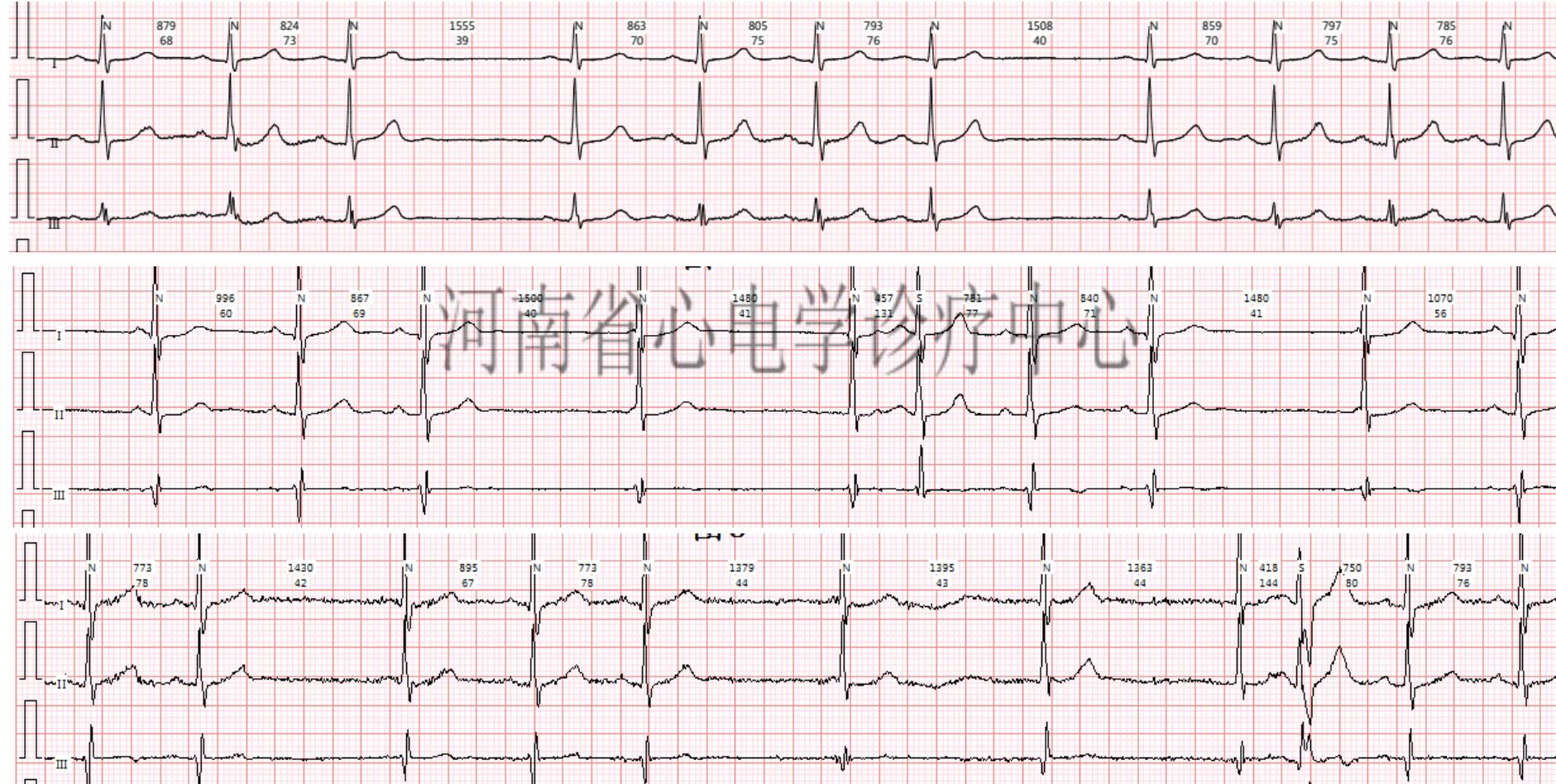


动态心电图诊断

1. 基础心律为窦性心律伴一度房室阻滞、文氏型房室阻滞，平均心率64bpm(38~113bpm)，心率变异性增大。
2. 交界性早搏有7307个，提示并行心律，其中有74阵二联律和26阵三联律。
3. 室性早搏有532个，其中1次成对。
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4. ST-T无异常动态变化。
5. 大于1.50秒的长周期1881个，最长RR间期2.09秒，为文氏型房室阻滞、房性早搏未下传所致，部分长周期后偶见室性逸搏。



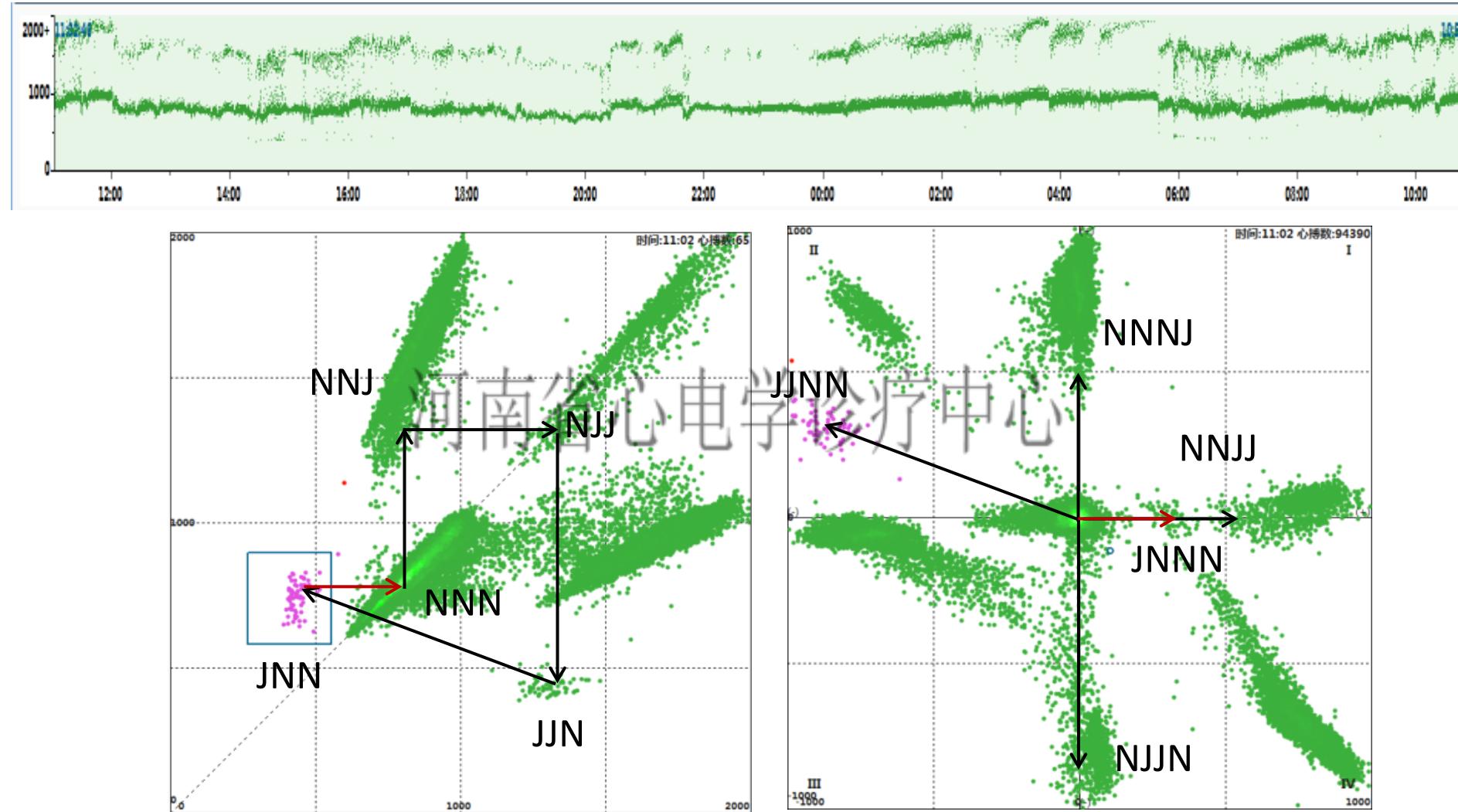
例4 逸搏心律的变异性分析





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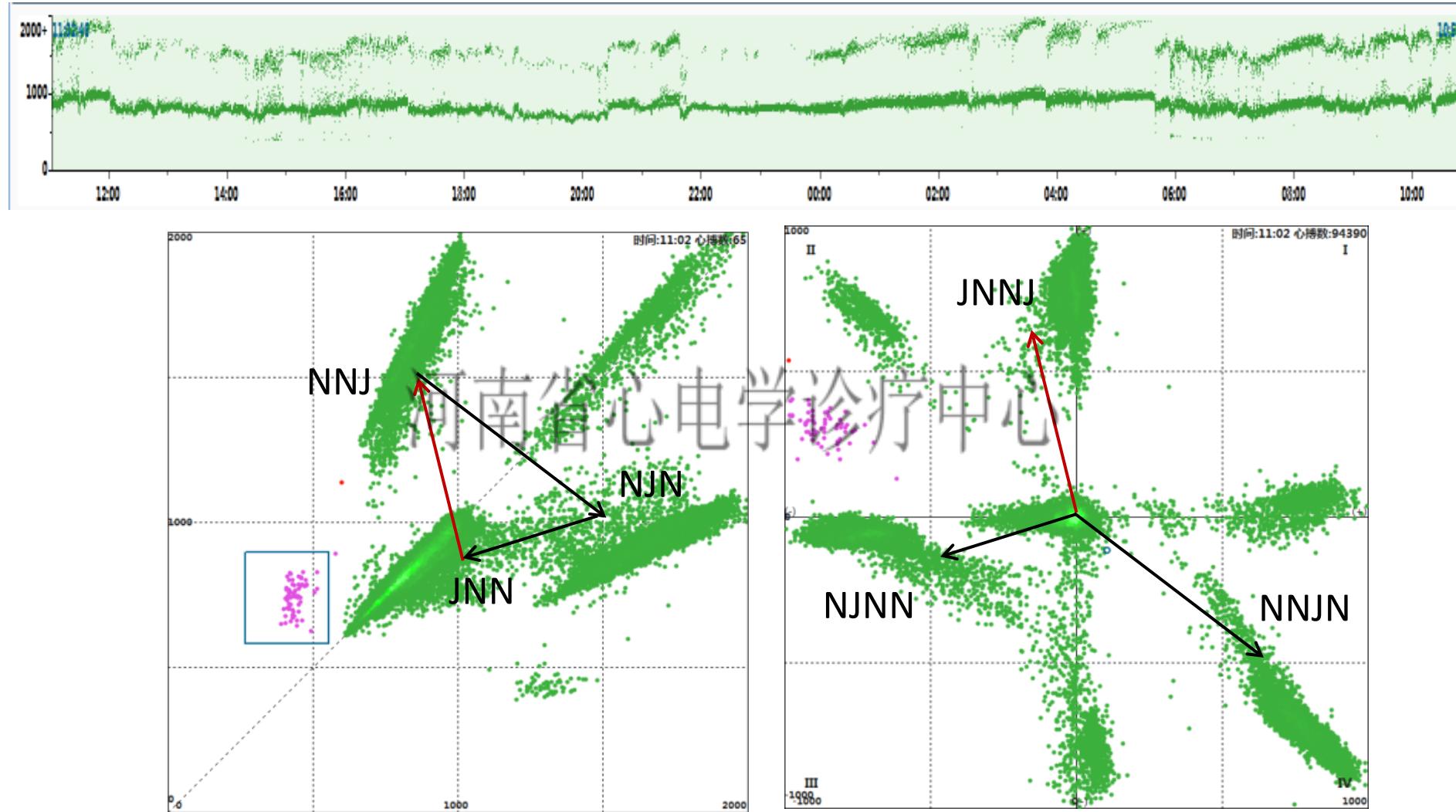
向量平移法

厚德 博学 精医 济世

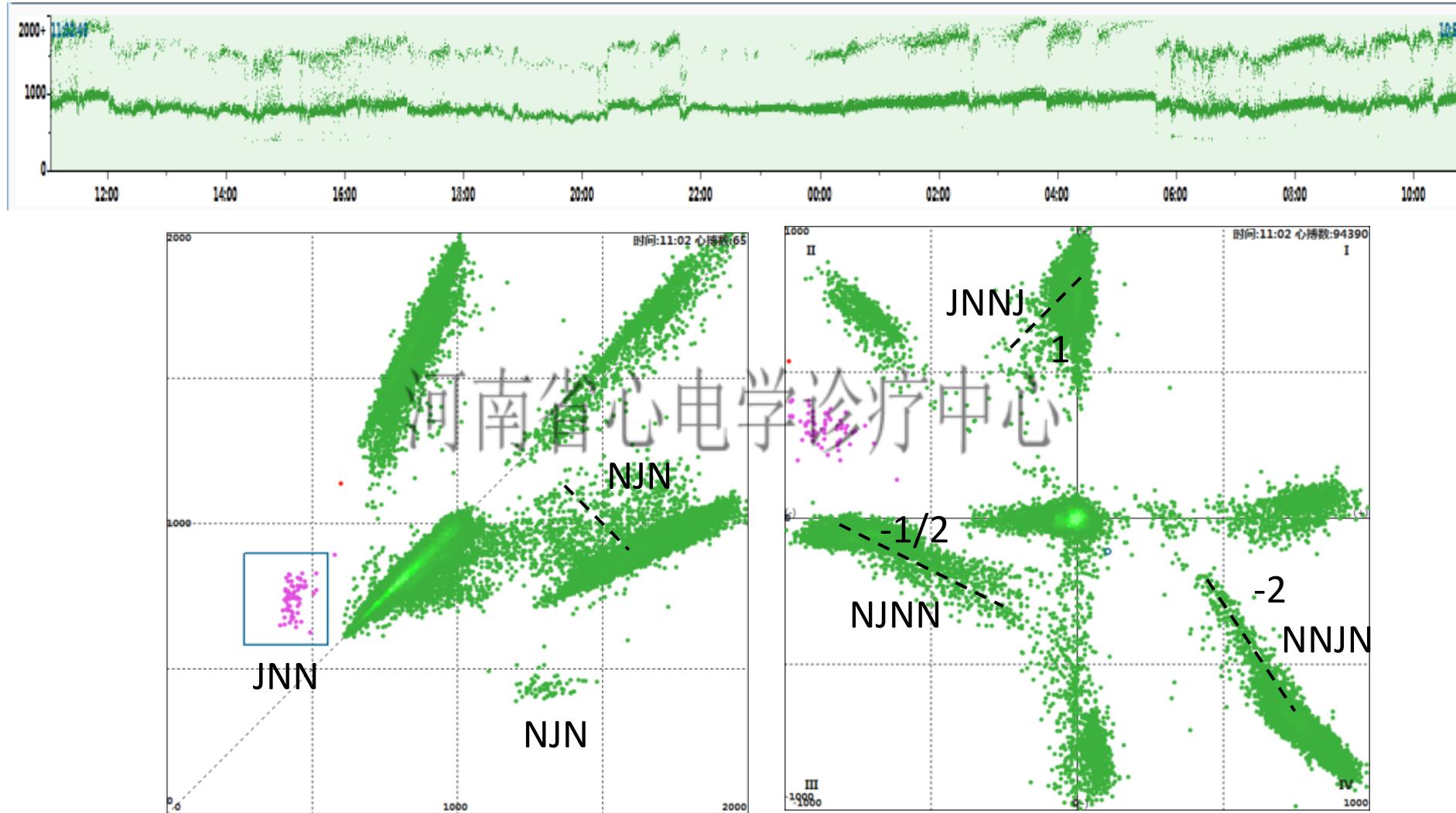


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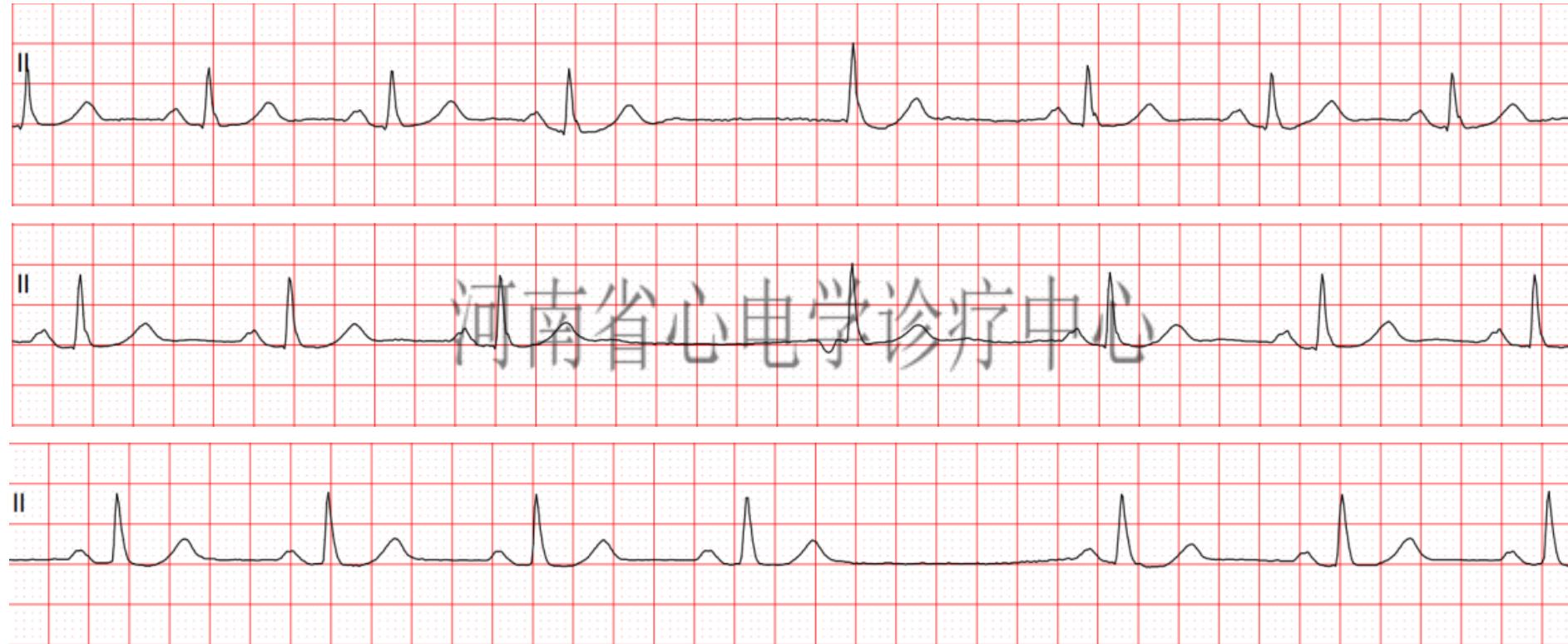


厚德 博学 精医 济世





例5 卢××，女，79岁

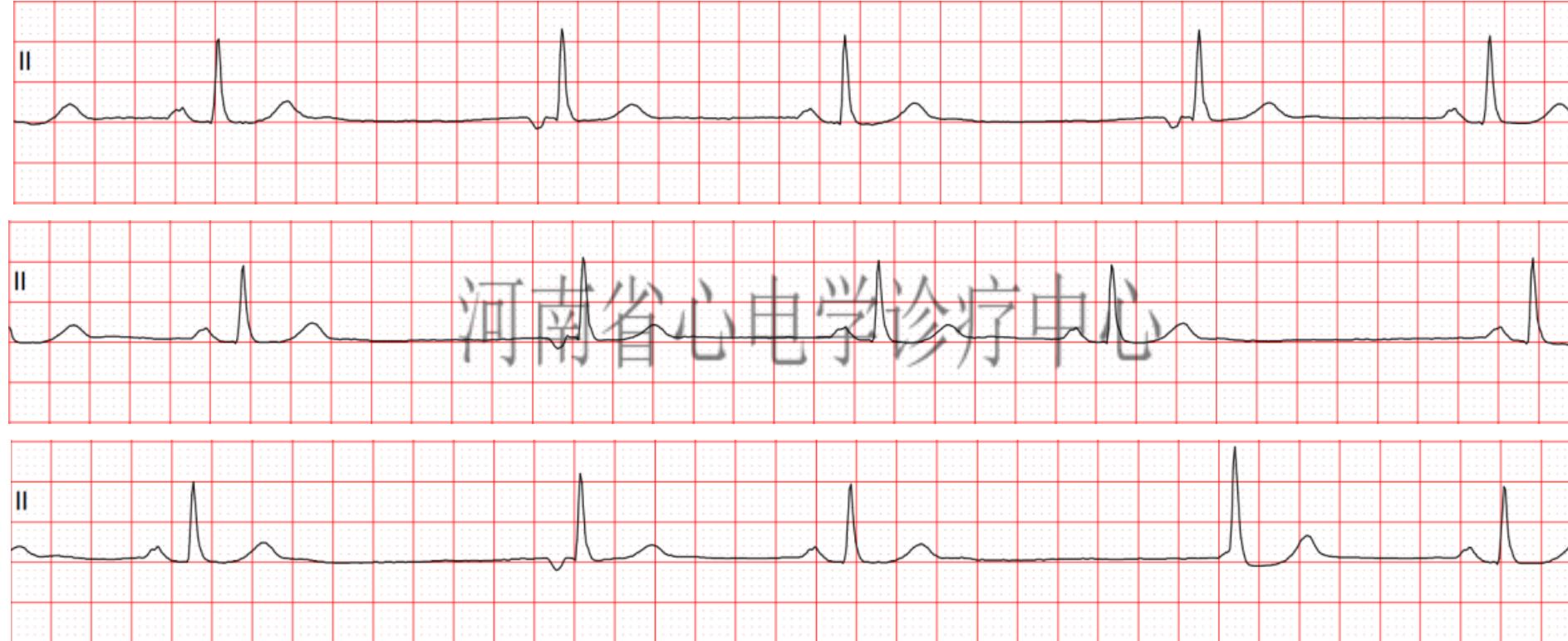




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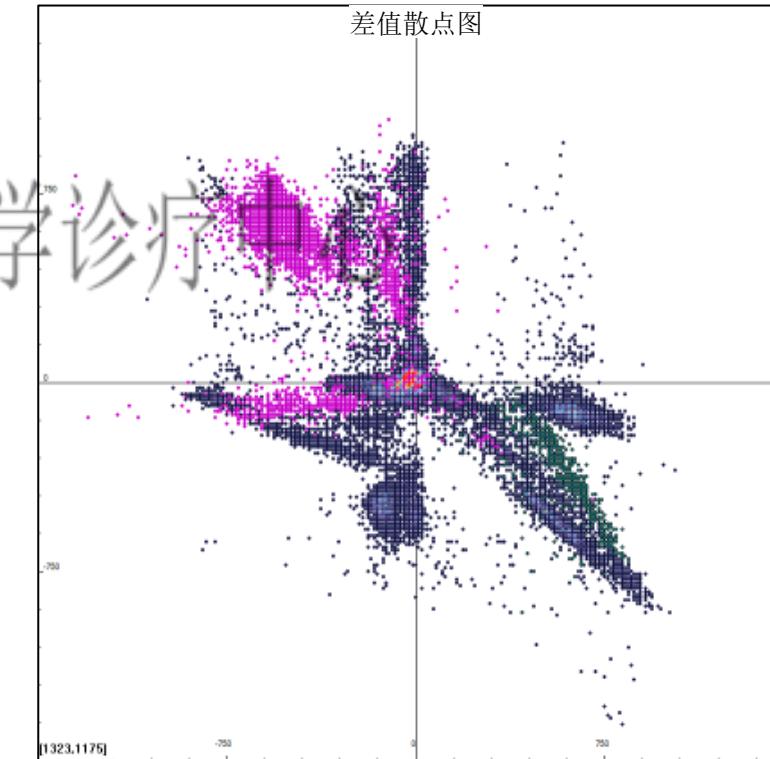
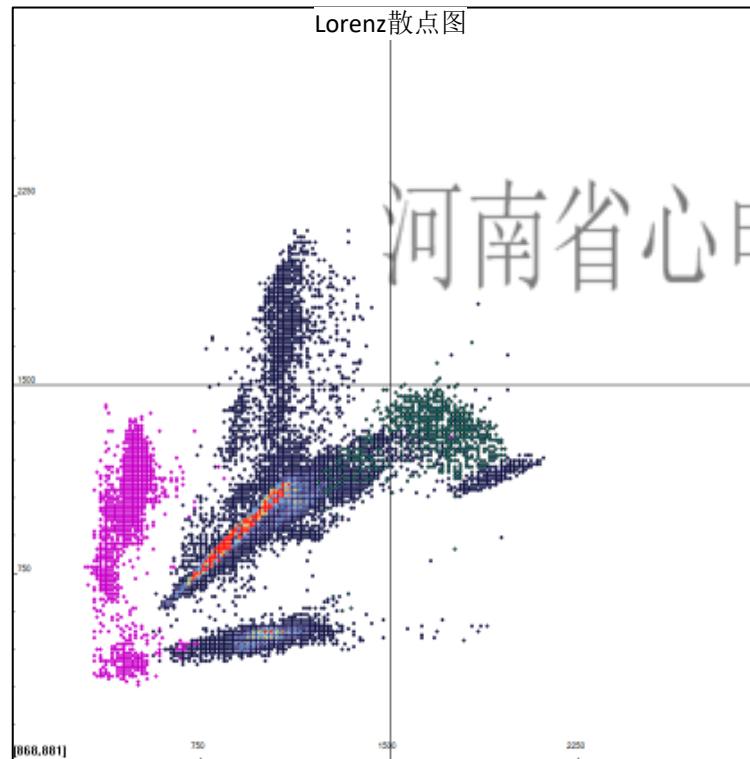
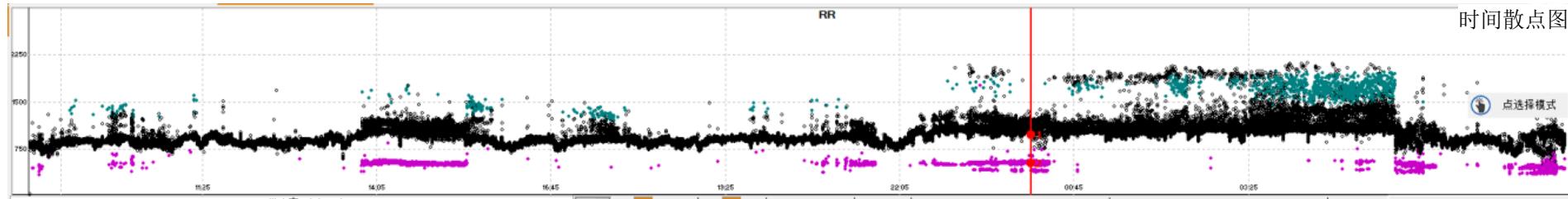
例5 卢××，女，79岁





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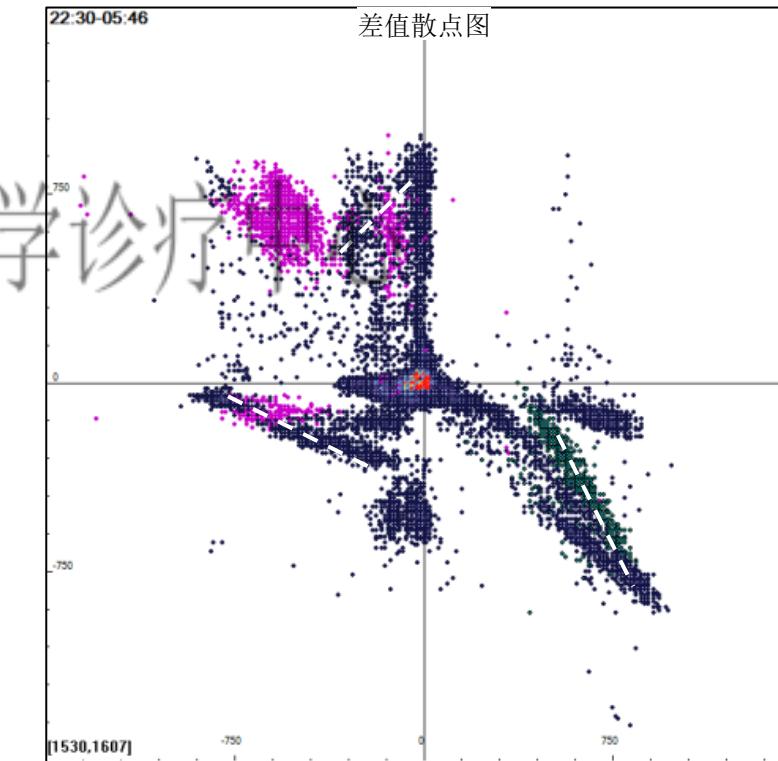
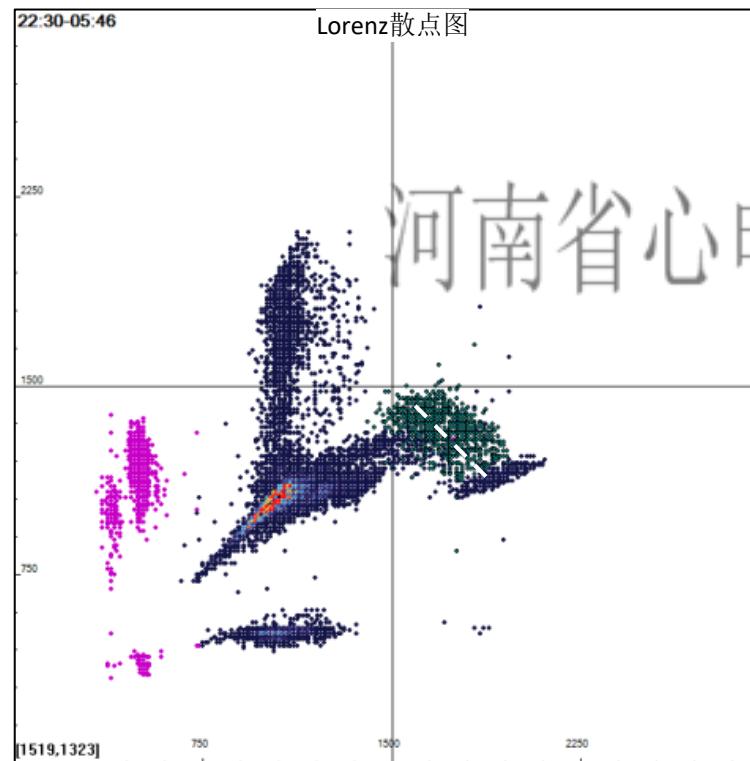
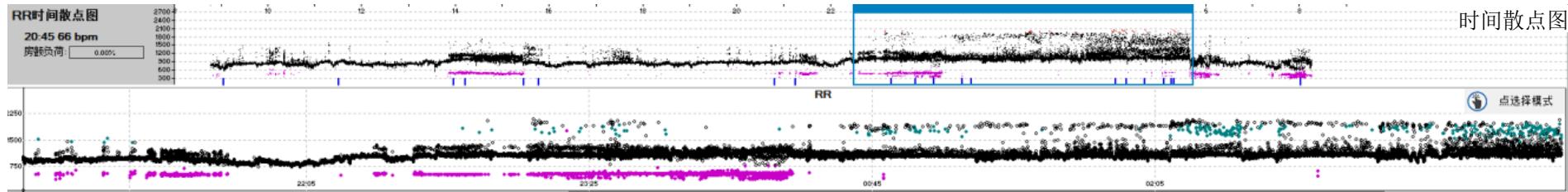


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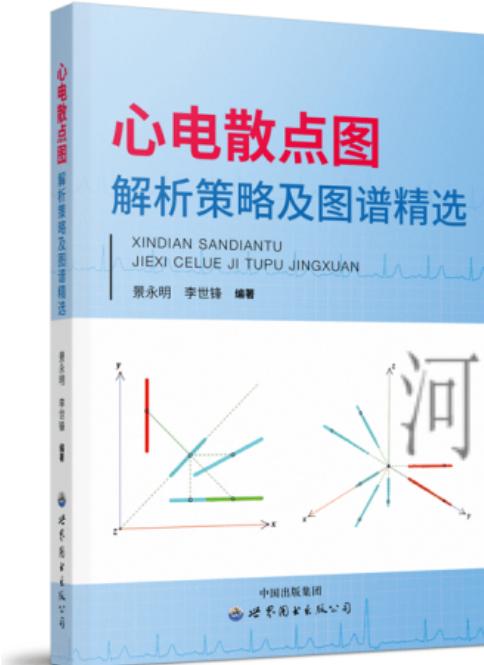
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小结

标识线	Lorenz散点图	差值散点图	三维Lorenz散点图 (xyz面)
等速线	$y=x$	$x'=0$ (z轴) $y'=0$ (-x轴) $x'+y'=0$ (y轴)	$x=y$ (z轴) $y=z$ (x轴) $z=x$ (y轴)
心率均等线	$x+y=b$	$x'+2y'=0$ $2x'+y'=0$ $x'-y'=0$	$x+y=2z$ $y+z=2x$ $z+x=2y$

两值守衡走实线，均值守衡走虚线



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The end