Global phase portraits of the quartic uniform isochronous centers

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We classify the global phase portraits in the Poincaré disc of all quartic polynomial differential systems with a uniform isochronous center.

We classify the global phase portraits in the Poincaré disc of all quartic polynomial differential systems with a uniform isochronous center of the form

$$\begin{cases} \dot{x} & = -y + xf(x,y), \\ \dot{y} & = x + yf(x,y), \end{cases} \tag{1}$$

where $f(x,y)$ is a polynomial of degree 3 with $f(0,0) = 0$.

The classification of the quartic uniform isochronous centers (1) consists of 16 topological different phase portraits.