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Phase singularities in cardiac electrical activity[1] ILIJA UZELAC, VENIAMIN SIDOROV, JOHN WIKSWO — Abstract theory of topological spaces has its analogy in biological systems, one of which is the heart. The heart is an excitable medium that can be represented as a set of excitable elements (cardiomyocytes) that behave similarly to hourglasses. Excitable element needs external stimuli to be excited and after finite time goes back to its initial state, so its natural topological space is a ring. Topological space set (phases) can be simple set as *"rest," "excited," "refractory," "relatively refractory",* but it can be as continuous as a set of angles on a 2π circle. In topological spaces topological charge is defined by:

$$W = \frac{1}{2\pi} \oint_l d\theta(l)$$

where l is the integration path and $d\theta$ is the change in phase. Non zero topological charge is called phase singularity of mapping. Practical application of topological charge analysis is a powerful method to quantify electrical dynamics during ventricular fibrillation (VF). Particularly by means of phase singularity detection it is possible to track wave breaks which relate to anatomical and electrophysiological heterogeneities.

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