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SUPER CENTRAL CONFIGURATIONS

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In this talk, we consider the inverse problem of central configurations of n-body problem. For a given $q = (q_1, q_2, \cdots, q_n) \in (\mathbf{R}^d)^n$, let $S(q)$ be the admissible set of masses by

$$S(q) = \left\{ m = (m_1, m_2, \cdots, m_n) | m_i \in \mathbf{R}^+, q \text{ is a central configuration for } m \right\}.$$

We call $m = (m_1, m_2, \cdots, m_n) \in S(q)$ and $m' = (m'_1, m'_2, \cdots, m'_n) \in S(q)$ *equivalent* if $m = \alpha m'$ for some $\alpha \in \mathbf{R}^+$ and let $\tilde{S}(q)$ be the set of equivalent classes in $S(q)$. Denote by ${}^{\#}\tilde{S}(q)$ the cardinal number of equivalent elements for any given configuration $q = (q_1, q_2, \cdots, q_n) \in (\mathbf{R}^d)^n$. We call q a super central configuration if ${}^{\#}\tilde{S}(q) \geq 2$. The possible values of ${}^{\#}\tilde{S}(q)$ and the structure of the set $S(q)$ are investigated for $n \leq 4$. The existence of super central configuration for $n > 4$ is constructed. We prove that all central configurations are super central configurations for $n \leq 3$ and no convex four-body central configuration is a super central configuration. We also prove that a super central configuration has an unusual property: a super central configuration gives rise to a perverse solution when center of mass of the configuration is fixed.

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