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Ulam's problem 19 and related problems

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This is a joint work with Maria Alfonseca, Alina Stancu and Vlad Yaskin. Ulam's Problem 19 from the Scottish Book asks: *is a solid of uniform density which will float in water in every position a sphere?* We will discuss this and related problems formulated by Croft, Falconer and Guy.

Quasi-monomials with respect to rotation and translation subgroups of affine plane group

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Let H be a subgroup of the plane affine group $\mathrm{Aff}(2)$ considered with the natural action on the vector space of two-variable polynomials. The polynomial family $\{B_{m,n}(x,y)\}$ is called quasi-monomial with respect to H if the group operators in two different bases $\{x^m y^n\}$ and $\{B_{m,n}(x,y)\}$ have identical matrices. We obtain a criterion of quasi-monomiality for the case when the group H is generated by rotations and translations in terms of exponential generating function for the polynomial family $\{B_{m,n}(x,y)\}$.

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