Abstract Submitted
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Contact mechanics of rough spheres[1] LARS PASTEWKA, MARK ROBBINS, Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD 21218 — We use large scale numerical calculations to study the contact mechanics of rough spheres on flat elastic solids. Such geometries are encountered in systems that range from ball bearings to atomic force microscope tips, but the influence of roughness is seldom considered explicitly. Our calculations show that the contact area A grows linearly with load N at small loads and crosses over to Hertzian behavior $A \propto N^{2/3}$ at large loads. The total contact stiffness is defined as $K = dN/dz$ where z is the normal displacement of the sphere. It shows power-law $K \propto N^{\alpha}$ behavior at all loads with an exponent α that is close to the value of $1/3$ expected from Hertzian contact mechanics. The results are discussed in the context of recent theories for flat rough contacts [1] and Greenwood-Williams theory as modified for spherical contacts [2].

[1] B.N.J. Persson, J. Chem. Phys. 115, 3840 (2001); S. Hyun, L. Pei, J.-F. Molinari, M.O. Robbins, Phys. Rev. E 70, 026117 (2004); S. Akarapu, T. Sharp, M.O. Robbins, Phys. Rev. Lett. 106, 204301 (2011)
[2] K.L. Johnson, Contact Mechanics, Cambridge University Press, 1987

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