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Photophoretic levitation of engineered aerosols for geoengineering

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Abstract

Aerosols could be injected into the upper atmosphere to engineer the climate by scattering incident sunlight so as to produce a cooling tendency that may mitigate the risks posed by the accumulation of greenhouse gases. Analysis of climate engineering has focused on sulfate aerosols. Here I examine the possibility that engineered nanoparticles could exploit photophoretic forces, enabling more control over particle distribution and lifetime than is possible with sulfates, perhaps allowing climate engineering to be accomplished with fewer side effects. The use of electrostatic or magnetic materials enables a class of photophoretic forces not found in nature. Photophoretic levitation could loft particles above the stratosphere, reducing their capacity to interfere with ozone chemistry; and, by increasing particle lifetimes, it would reduce the need for continual replenishment of the aerosol. Moreover, particles might be engineered to drift poleward enabling albedo modification to be tailored to counter polar warming while minimizing the impact on equatorial climates.

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Footnotes

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