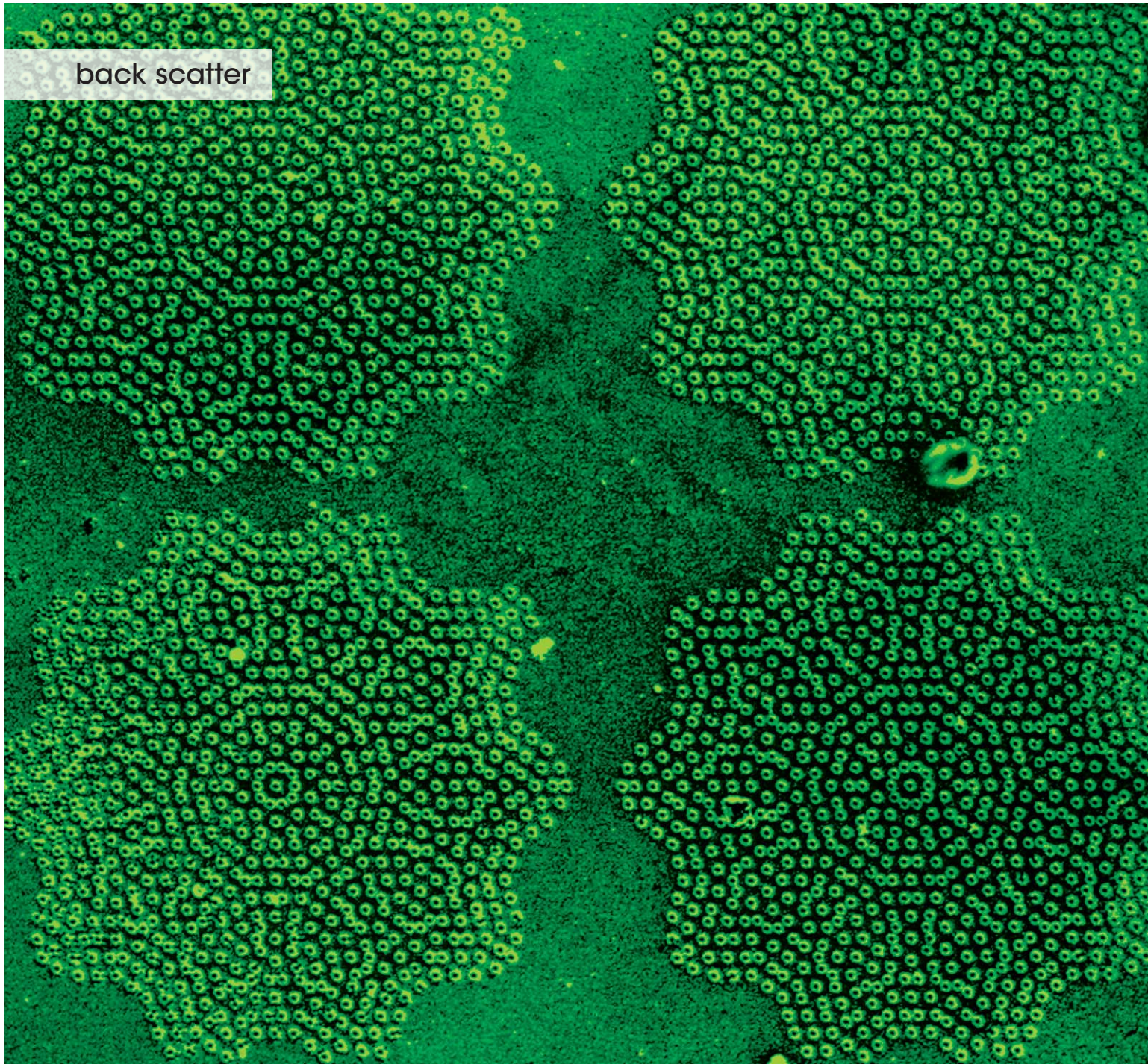




## Magnetic molds

Bartosz Grzybowski and colleagues at Northwestern University have demonstrated a new technique for precisely assembling colloidal particles into complex two- and three-dimensional arrangements. The process begins with a template: The researchers used photolithography to fabricate a pattern of nickel islands, 1–10 microns in diameter and 200 nanometers thick, and embedded the islands in a layer of silicone to create a flat surface. They then placed the template on a 0.4-tesla permanent magnet and underneath a solution of colloidal particles in a paramagnetic holmium nitrate solution. Because nickel has a large magnetic susceptibility, the template modulates and concentrates the magnet's otherwise uniform field. The resulting microgradients in the fluid form a magnetic mold that draws paramagnetic particles onto the islands and pushes diamagnetic particles into the gaps between the islands. If desired, the particles can be configured to bond together, so that the structure remains even after the magnet is removed.

This scanning electron micrograph shows quasicrystalline assemblies of nonmagnetic silica beads created with a magnetic mold. For a wide variety of templates and colloids, the team reports fidelity greater than 80%. The process has great versatility: Not only can one adjust the shape of the islands and their relative size with respect to the colloidal particles, but since the gradients extend vertically into the fluid, the molds can assemble particles into 3D clusters. The team even created colonies of bacteria. (A. F. Demirörs et al., *Nature*, in press. Image by Ahmet Demirörs.)

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