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Modular forms with singularities

Ordinary modular forms (without singularities) are by now a central part of mathematics; for example, Wiles' proof of Fermat's last theorem was largely about modular forms. On the other hand, modular forms with singularities are much less well understood, and at the moment the subject consists mainly of weird examples. I will try to explain some of these examples that turn up related to apparently unconnected areas such as moduli spaces, or Donaldson invariants, or sporadic groups, or Kac-Moody algebras, or complex hyperbolic reflection groups.