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Donaldson's theorem

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Theorem Let M be a smooth simply connected, closed 4- manifold. If the bilinear form induced on $H_2(M; \mathbf{Z})$ by the cup product is positive definite, then it may be represented by the identity matrix.

One application is the existence of exotic \mathbf{R}^4 's. See Donaldson Freedman exotic \mathbf{R}^4 .