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Principal bundles over smooth manifolds

Definition. Principal bundles over smooth manifolds

A smooth **principal right H -bundle** P over a smooth manifold M for a Lie group H is a smooth manifold P with a smooth *right* action of H

$$\begin{array}{ccc} P & \curvearrowright & H \\ \downarrow \pi & & \\ M & & \end{array}$$

such that

- H preserves the fibers of π and the action

$$P_x := \pi^{-1}x \curvearrowright H$$

is free and transitive (that is, P_x is a H -torsor)

$$\begin{array}{ccc} \Gamma \backslash G & \curvearrowright & H \\ \downarrow & & \\ \Gamma \backslash G / H & & \end{array} \qquad \begin{array}{ccc} G & \curvearrowright & H \\ \downarrow & & \\ G / H & & \end{array}$$

Current note has 2 direct children and 2 total descendants.

- [structures based on sets](#)
 - [manifolds](#)
 - [Principal bundles over smooth manifolds](#)
 - [Cartan geometry](#)
 - [Gauge theory on \$G\$ -bundles](#)

And it has 20 siblings.

- [structures based on sets](#)
 - [manifolds](#)
 - [Closed aspherical manifolds](#)
 - [ℂ-manifold](#)
 - [Hermitian manifolds](#)
 - [Kahler manifolds](#)
 - [Kahler manifolds of complex dimension 2, AKA Kahler surfaces](#)
 - [smooth ℝ-manifold](#)
 - [Principal bundles over smooth manifolds](#)
 - [Manifold with a flow](#)
 - [ℝ-manifold group \(Lie groups\)](#)
 - [Homogeneous manifold](#)
 - [Finsler manifold](#)
 - [ℝ-manifold semi-Riemannian](#)
 - [Sub-Riemannian manifolds](#)
 - [ℝ-manifold Poisson](#)
 - [ℝ-manifold symplectic](#)
 - [Multisymplectic manifolds](#)
 - [Spin ℝ-manifold](#)
 - [ℝ-manifold topological](#)
 - [Toric manifolds](#)
 - [Manifolds with compatible triples](#)