

**Abstract of the introductory talk by Marco Marengon.** I will explain a way to build a (smooth)  $n$ -dimensional manifold by gluing together elementary pieces, called “handles”.

I will briefly discuss the case of 2-dimensional manifolds, i.e. surfaces (for which we can still draw figures), and use them to have an intuition of how the recipe works in higher dimensions.

I will focus in particular on the case of (smooth) 4-dimensional manifolds, where the “handle” recipe is of paramount importance and has a special, fancy name: Kirby calculus.

**Abstract of the main lecture by András Stipsicz.** The aim of this lecture is to give an overview of the smooth four-dimensional Poincaré conjecture. Indeed, it is still an open problem whether a smooth four-dimensional manifold homeomorphic to the four-dimensional sphere is diffeomorphic to it.

In the lecture we will discuss the difference between topological and smooth manifolds, review what is known about the problem in other dimensions and give a construction for potential ‘exotic’ four-spheres. The construction relies on knotted two-spheres in the four-dimensional sphere; such a knotted object, in turn, can be described by knots (knotted circles in the three-dimensional space).