

**Abstract of the talks.** In these lectures we will discuss the venerable problem of representing an integer  $n$  as a sum of  $k \geq 2$  squares of integers ( $k = 2, 3$  or  $4$ ).

In the first part of the talk we will provide a fairly complete proofs of the 2-squares Theorem (Fermat), the 4-squares theorem (Lagrange) and of the 3-squares theorem (Gauss/Legendre).

In the second part, we will describe the shape of the set of such representations (when viewed as a set of vectors on the sphere of radius  $\sqrt{n}$  in  $\mathbb{R}^k$ ). This will lead us to the theory of modular forms, their associated  $L$ -functions and if times permits to interesting dynamical systems.