The Nobel Prize in Physics 2018 Presentation

Presenter: Prof. Dr. Arnulf Materny
Spacetime Coordinates: 26/10/18 19:00, RIII Lecture Hall

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Physics 2018 “for groundbreaking inventions in the field of laser physics” with one half to Arthur Ashkin (Bell Laboratories, Holmdel, USA) “for the optical tweezers and their application to biological systems,” and the other half jointly to Gérard Mourou (École Polytechnique, Palaiseau, France University of Michigan, Ann Arbor, USA) and Donna Strickland (University of Waterloo, Canada) “for their method of generating high-intensity,ultra-short optical pulses.” *The Academy published this announcement beginning of October and it is certainly a good idea to learn more about these important discoveries.*

In my presentation, I will introduce to you the physics behind the techniques, which have been found worthy of a Nobel Prize. I will start with the fundamentals of “light amplification by stimulated emission of radiation,” which is better known to you as “laser.” I will tell you why “modes” are the essential basis for understanding “chirped pulse amplification” (CPA) and only modes explain why a laser focus can act as “tweezer”. What is required to convince a laser to emit its light as pulses? What do birds and laser pulses have in common? Why do you try to avoid this feature for applications while when you want to have intense laser pulses, you cannot live without it? Why can you trap solid or liquid particles in air, but gas bubbles in liquids in most cases escape the laser focus? Why only in most cases?

Many open questions, which I will hopefully be able to answer.