History of the Laser

Advanced

- Lasers are one big success story – and an embodiment of **Feynmans** famous sentence:
  - *"There are certain situations in which the peculiarities of quantum mechanics can come out in a special way on a large scale."*
  - It is *not* necessary to to emphasize how important lasers are to all of us – to the scientist, the patient in a hospital, the consumer listening to her discs, the supermarket cashier, the geometer – and just about everybody else. It should be quite clear.
  - It is, however, *quite* necessary to emphasize that lasers – and, of course, all of solid state electronics – are purely *quantum mechanical devices*, because this is simply not known to the "people in the street" (including those in suits; and this says something about the state of general eduction in this country).
- Here are a few milestones in the development of the laser.
- The first major date is **1916**, when Albert **Einstein** introduced the concept of *stimulated emission*.
  - The first experimental verification of stimulated emission was obtained in **1928** (by W. R. Ladenburg).
- It took till **1953** to experimentally demonstrate not only stimulated emission but amplification of radiation. This was achieved by **Gordon**, **Zeiger** and **Townes**.
  - The researchers used the two lowest vibrational energy levels of ammonia molecules and obtained a very narrow emission line at **12.6 mm**, i.e., in the "micro"wave region.
  - This is where the name "*maser*" comes from.
  - Follow-up on the "maser" finally led to the **1964 Nobel prize in physics** being shared between *Townes* and, for their contributions to the underlying theory, the Russians **Basov** and **Prokhorov** .
- Meanwhile, however, **Maiman** produced the first *optical maser*, as the laser was originally called in **1960**.
  - The light came from **Cr^{3+}** ions fixed in an **$Al_2 O_3$** crystal – in other words, a **ruby** – at a wavelength of **694.3 nm**.
  - Pumping took place with an intense light source, and the laser only emitted a short pulse.
- The first **semiconductor lasers** started working in **1962**: Three different research groups achieved lasing ##from different devices##.
  - The light came ### at a wavelength of **694.3 nm**.
  - Pumping took place ###.