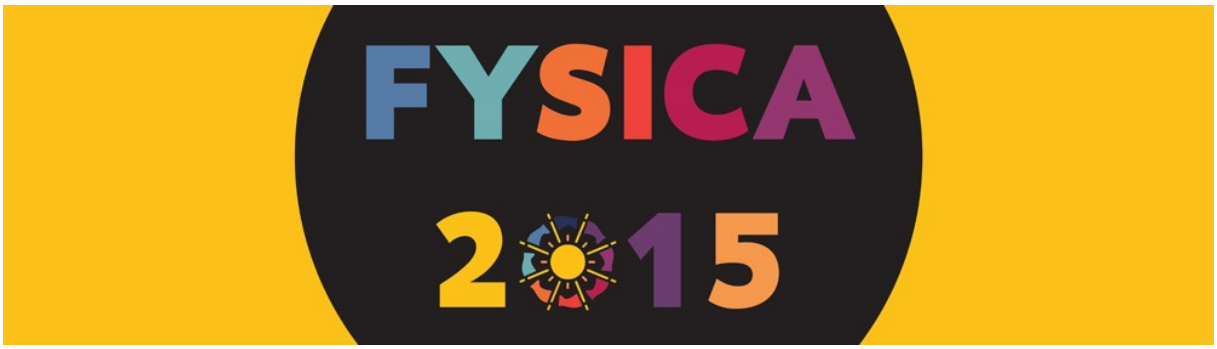

TU/e
10 April 2015

Focus Session: Light – International Year of Light 2015

Programme:

- Jan Denneman (Philips) – History of lighting: from analogue to digital
- Wim Ubachs (VU) - Light from the early universe and the nature of physical law
- Wilbert IJzerman (Philips) - The theory behind illumination optics
- Reinder Coehoorn (Philips) –

Session leader: Sander Nijdam (TU/e)

Abstracts:

Jan Denneman (Philips) – History of lighting: from analogue to digital

Wim Ubachs (VU) - Light from the early universe and the nature of physical law

The very largest optical dish telescopes on Earth capture and collect the light emitted by quasars in the early epochs form our universe evolving. In that light information is imprinted from atomic and molecular species as existing in intervening galaxies billions of light-years away from us. From the redshift of these spectra we can derive how far away those absorbing galaxies are discerned. We have performed observations with the ESO-VLT (Paranal, Chile) detecting molecular hydrogen at redshifts z=2-4.2, corresponding to look-back times of 11-12.5 billion years corresponding to 90% of the age of the Universe. From this we conclude that the Universe in those early stages consisted of atomic and molecular matter, similar as the species we know now. In addition, careful inspection of the spectra obtained allows us to derive information on the fundamental forces that bind atoms and molecules. From the H_2 spectra we derive that the proton-electron mass ratio has changed by less than 0.001%. This constancy of a fundamental constant of nature implies that the laws of physics have remained constants within the same constraint. Apart from hydrogen also the methanol molecule is identified as a sensitive probe to detect a possible variation of fundamental constants in the Universe at intermediate look-back times (7.5 billion years).

Wilbert IJzerman (Philips) - The theory behind illumination optics

With the introduction of LED lighting more form freedom is obtained for the optical components in lamps and luminaires.

Firstly due to the lower temperature of LEDs compared to conventional technology plastic transparent lenses can be used. Plastic lenses allow more design freedom compared to glass based lenses or metallic reflectors. In practice ray tracing is used to design the plastic lenses by trial and error. However, it is also possible to calculate the lens without performing any ray tracing in a direct method. This method is very challenging from a mathematical point of view. We will give some examples how this problem can be solved.

Secondly we start to use scattering elements in our designs to create a prescribed light distribution. Scattering itself is well understood in case we have a very transparent material (like the galaxy) or a highly diffusive material (like milk). In practice we are just between those two limits and existing theory is not accurate enough to predict the optical properties. We will show how dust particles in a plasma help us to understand the underlying physics.

Reinder Coehoorn (Philips) –