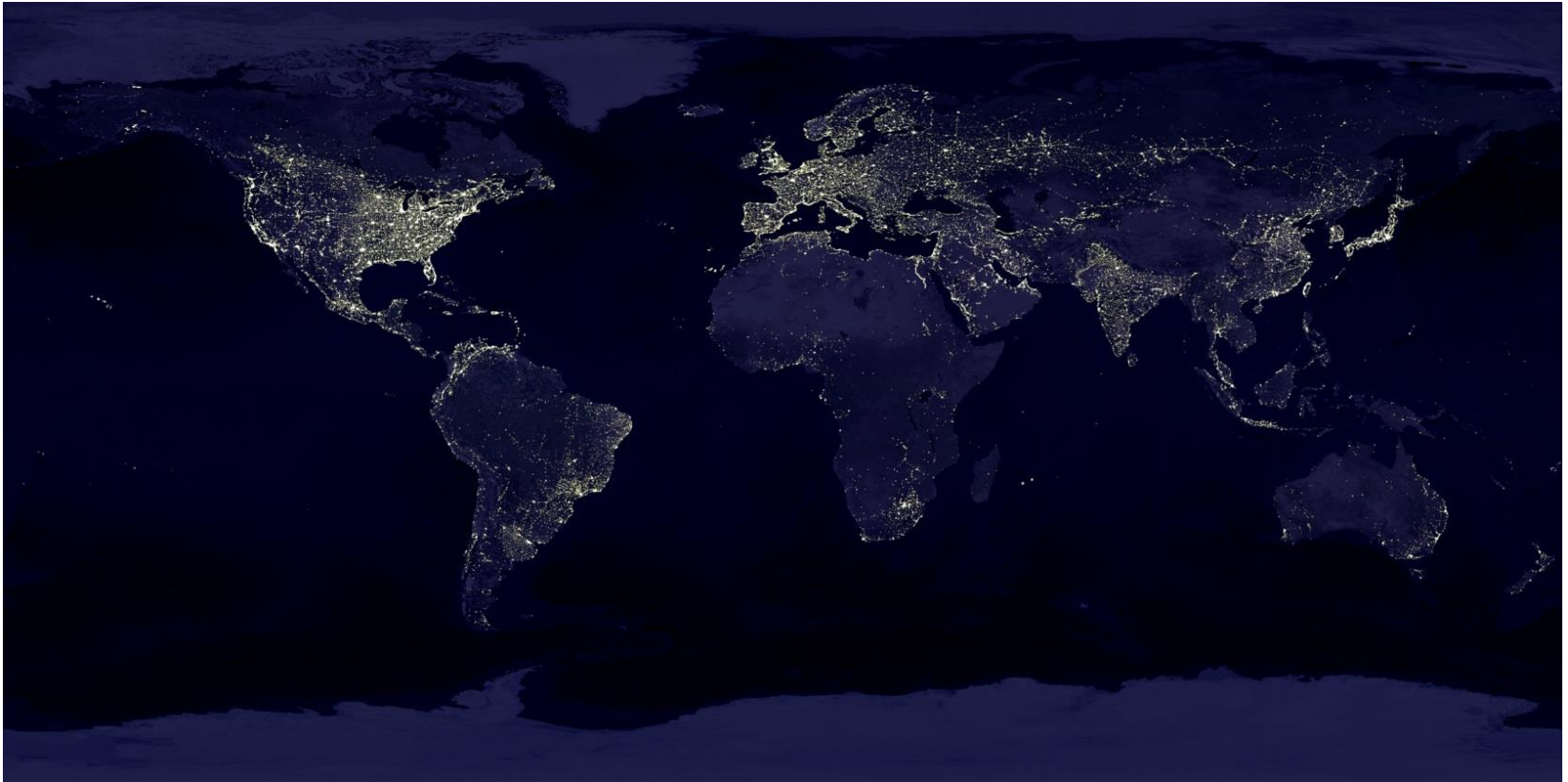


Kristallid, footonid ja inimesed nende ümber

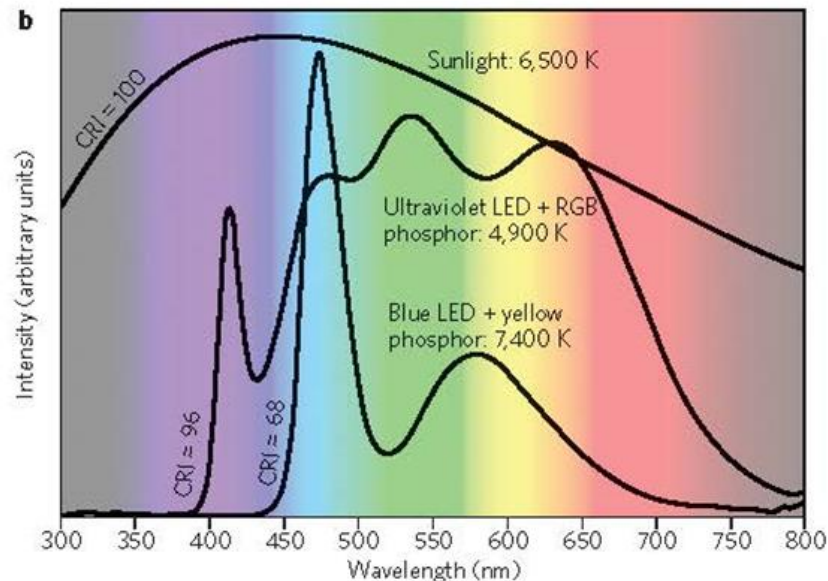
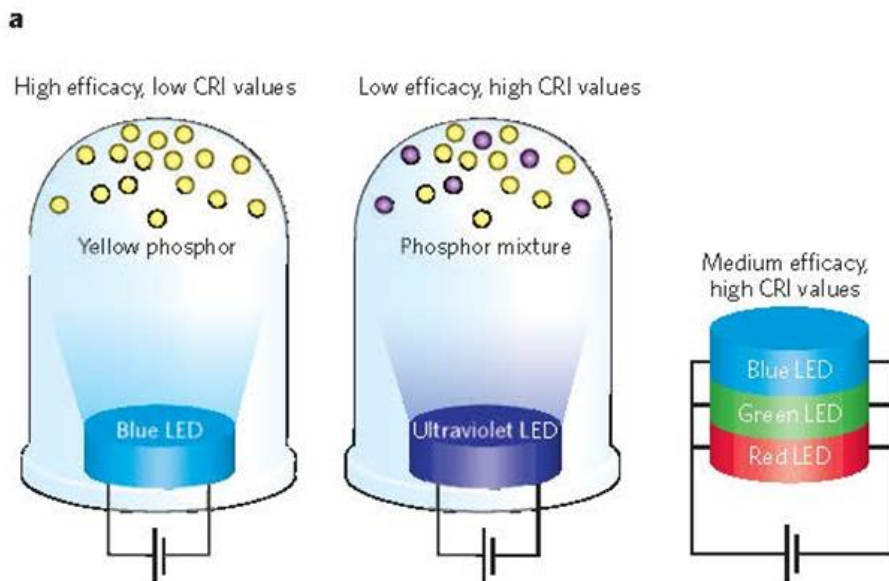
Marco Kirm
Eksperimentaalfüüsika professor
Füüsika Instituut
Tartu Ülikool





- ~20 % kogu elektrienergia toodangust kulub valgustamiseks

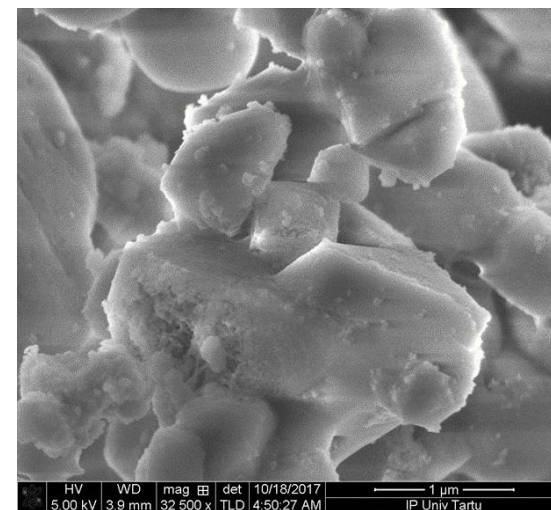
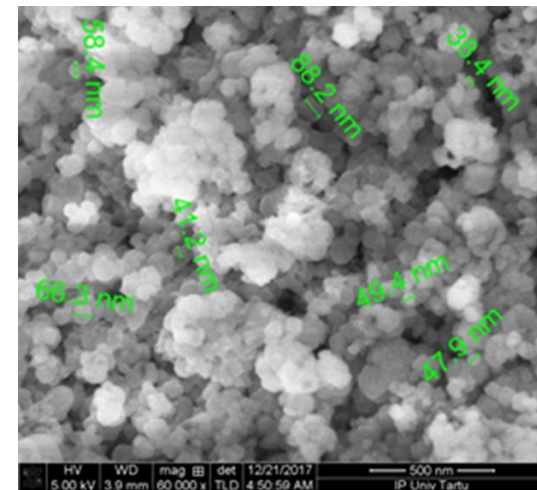
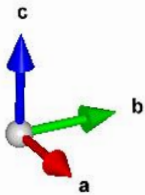
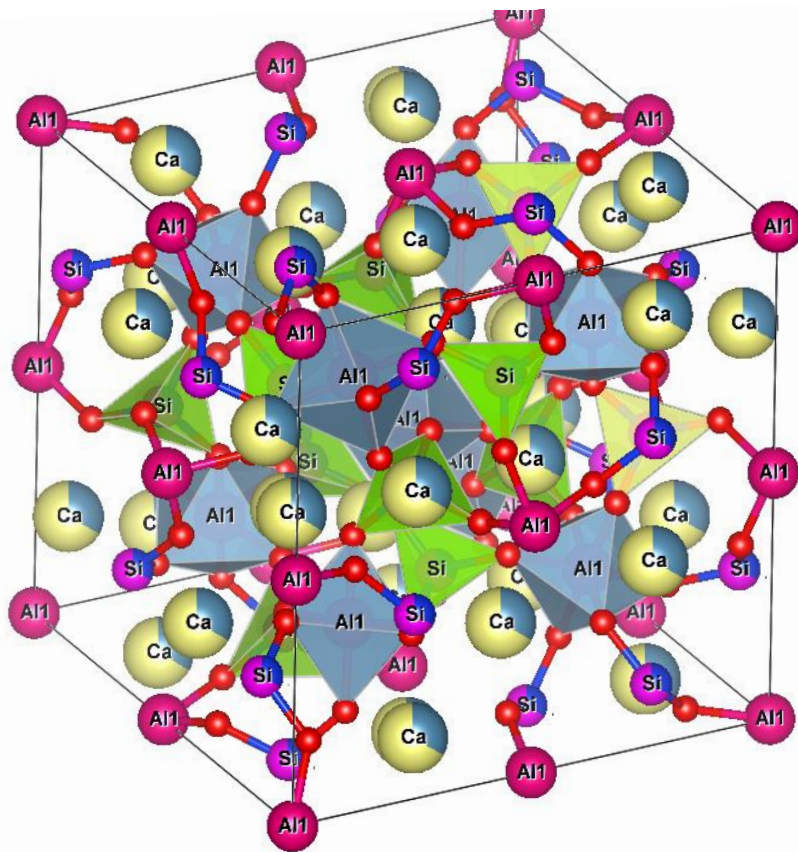
LED valgustuslahendused



Punases spektriosas kiirgavad nt Eu^{3+} ja Mn^{4+} ioonid

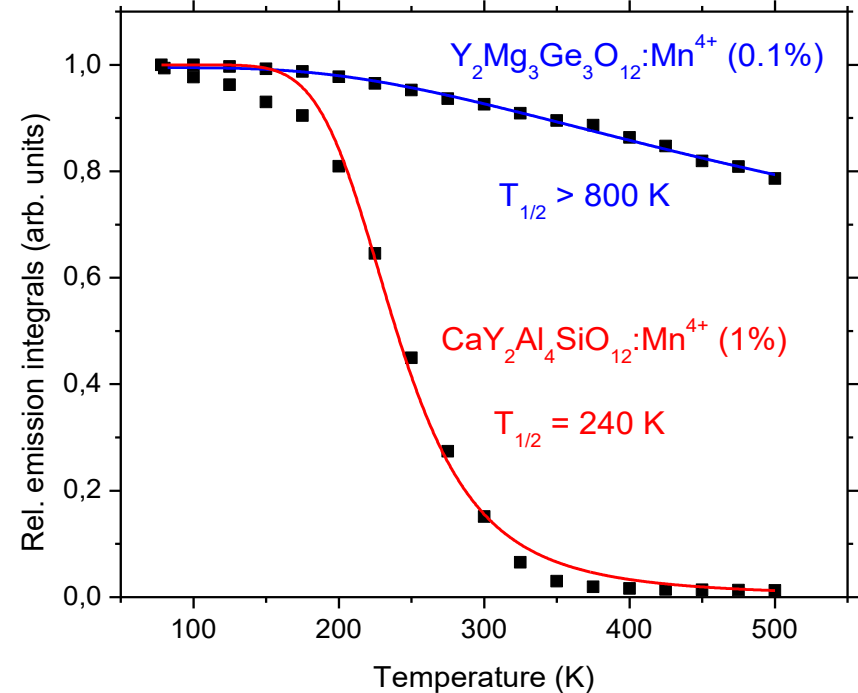
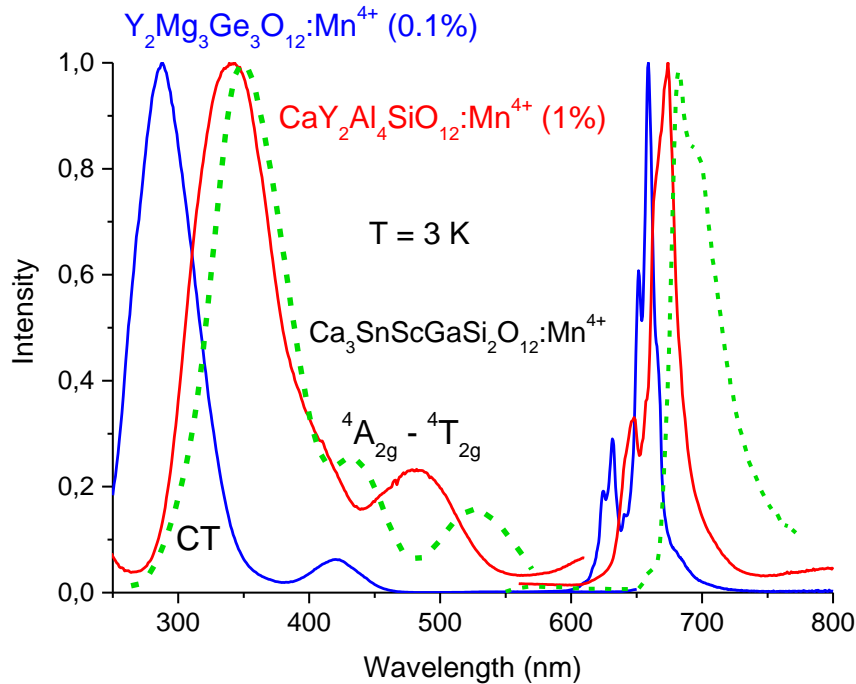
S. Pimputkar, *et al.*, Nature Photonics **3** (2009) 180

Granaadid $\{CaY_2\}[M_2](Al_2Si)O_{12}$ (M = Al, Ga, Sc)



Dodekaedriline võresõlm: {Ca} = Ca, Y
 Oktaedriline võresõlm: [Al1] = M (Al, Ga, Sc), Mn⁴⁺
 Tetraedriline võresõlm: (Si) = Si, Al, Ga

Punase kiirgusega Mn⁴⁺ fosfooride LED materjalide spektraalomaduste ja temperatuurse kustumise võrdlus

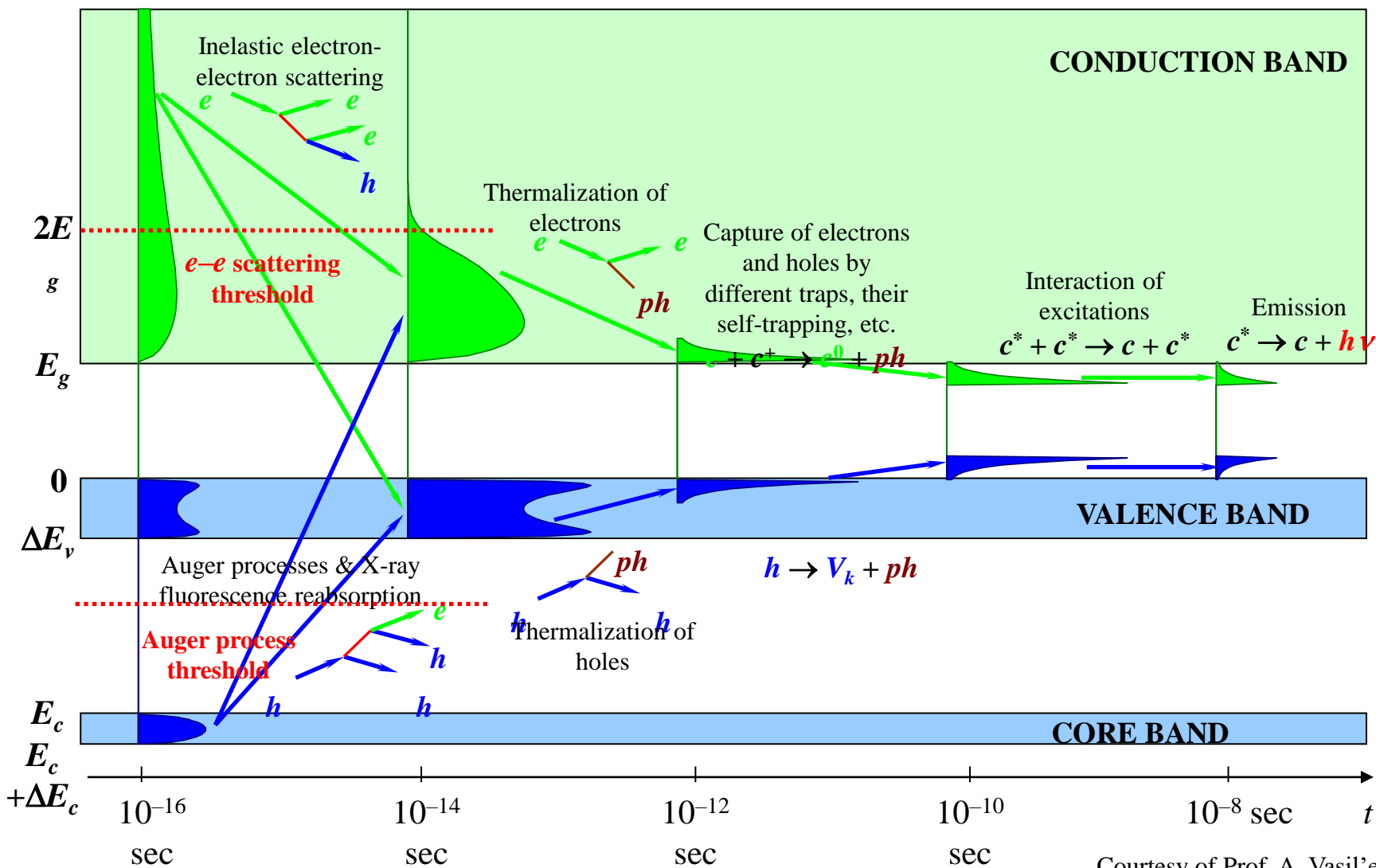


Narrow Band Deep Red Photoluminescence of Y₂Mg₃Ge₃O₁₂:Mn⁴⁺,Li⁺ Inverse Garnet for High Power Phosphor Converted LEDs

By: Jansen, T.; Gorobez, J.; Kirm, M.; et al.

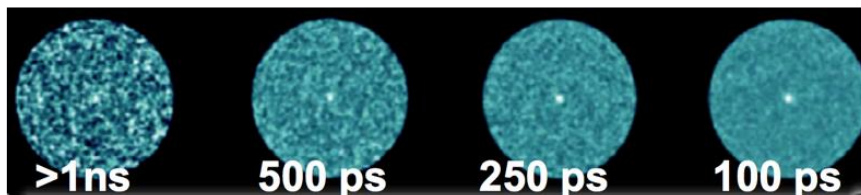
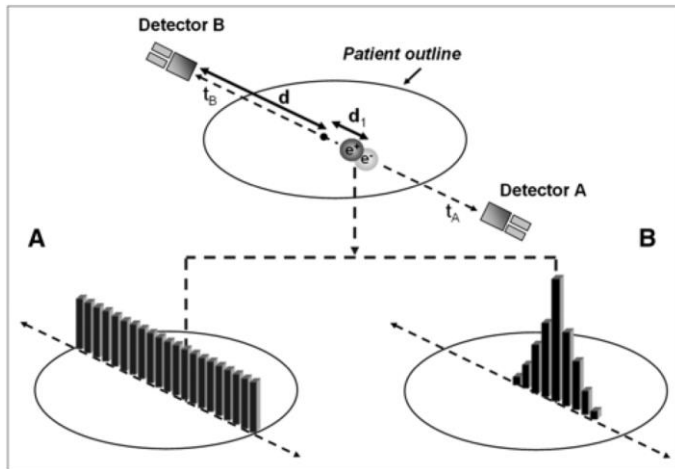
ECS JOURNAL OF SOLID STATE SCIENCE AND TECHNOLOGY Volume: 7 Issue: 1 Pages: R3086-R3092 Published: 2018

Elektronergastuste relaksatsioon



Meditsiiniline diagnostika TOF PET

TOF PET SIEMENS: BIOGRAPH VISION

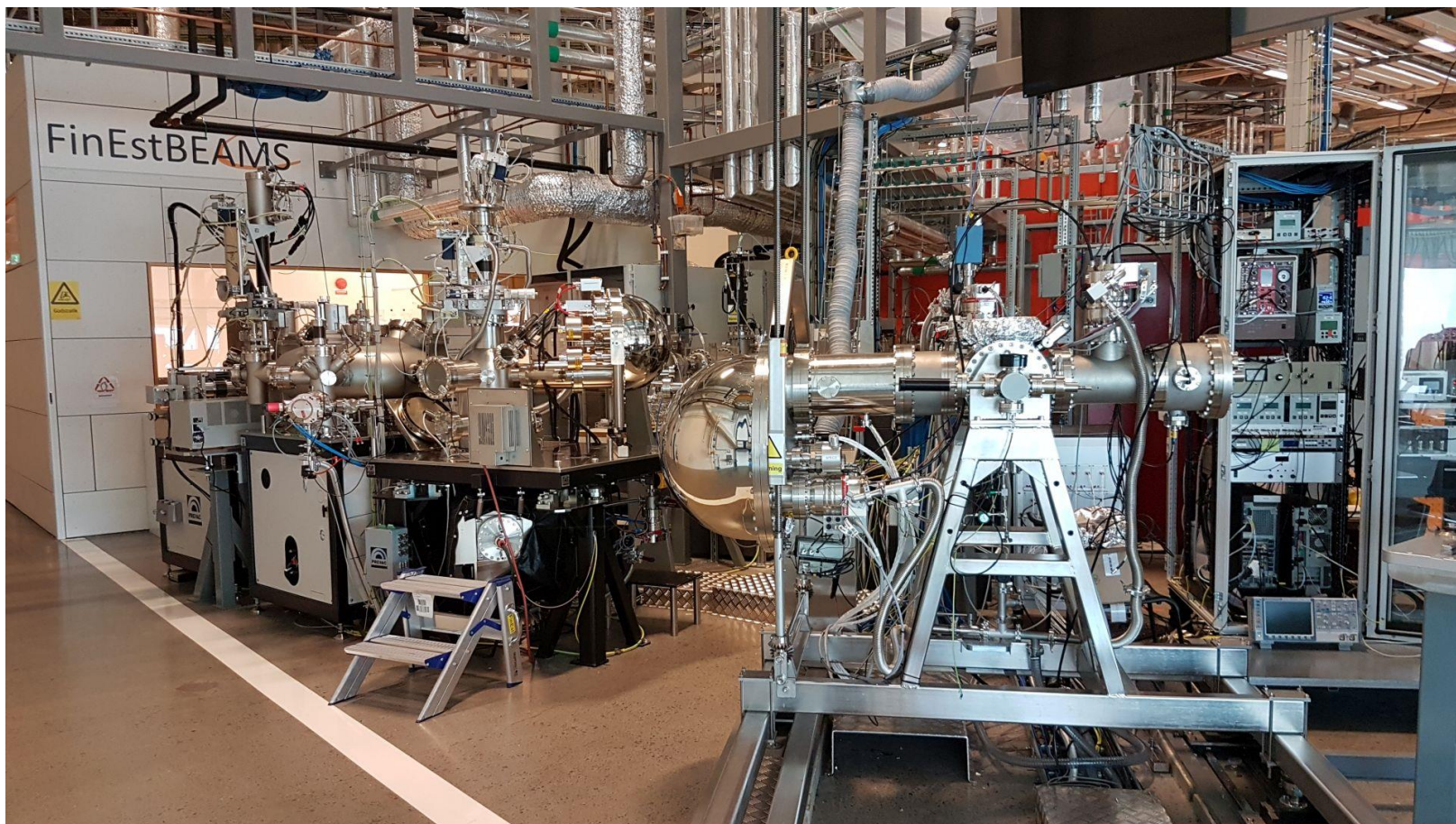


10 ps

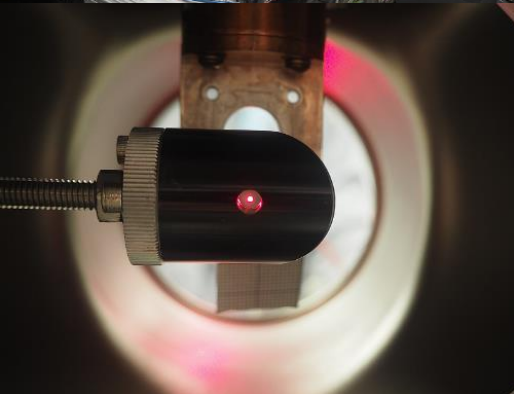
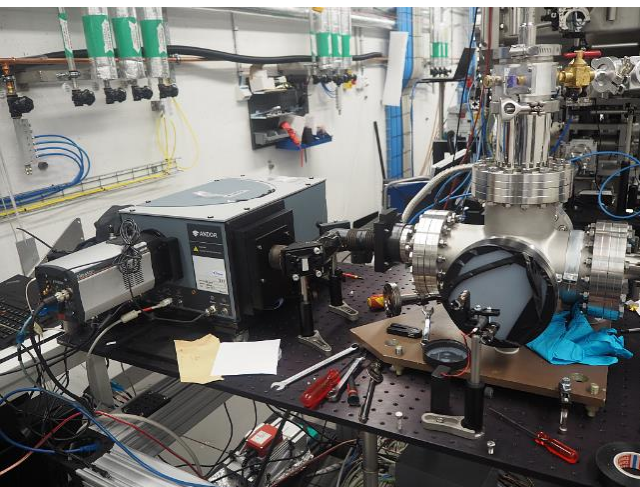


Suur uurimiskeskus Rootsi rahvuslabor
MAX IV Lab
Lundis Rootsis

Eesti – Soome kiirekanal
FinEstBeAMS -2018

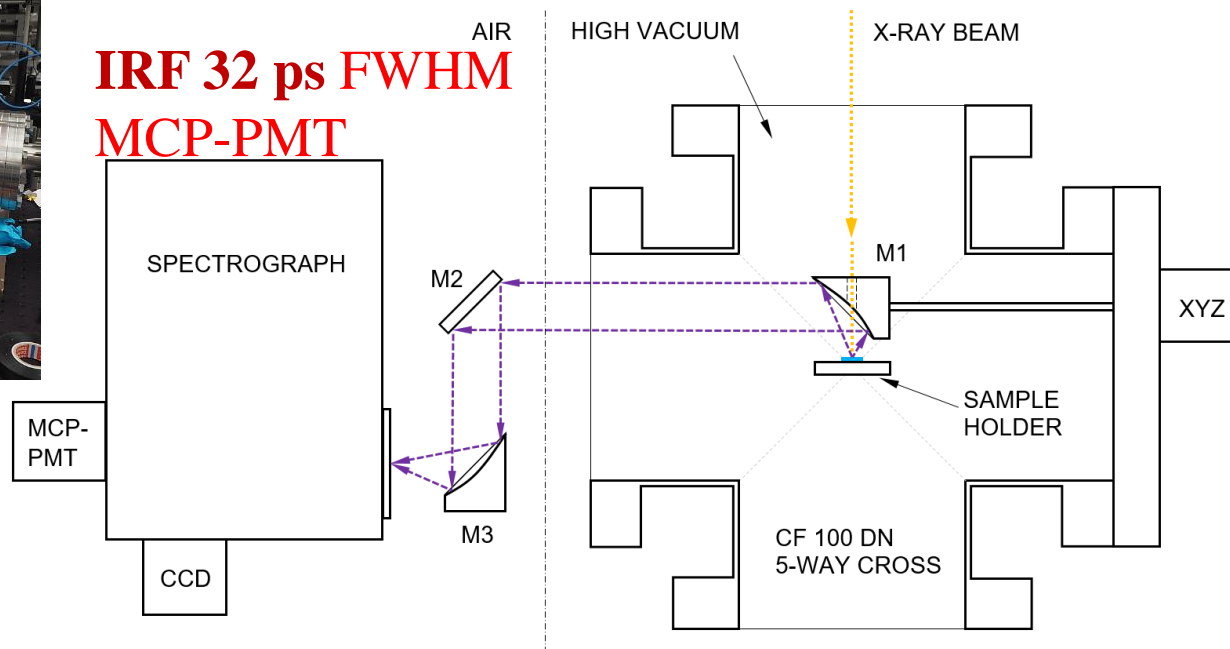


Ülikiire luminesentsi uuringuteseade FemtoMAX kiirkanalil



Linac + undulaator → 10 KeV, $\delta t < 200$ fs

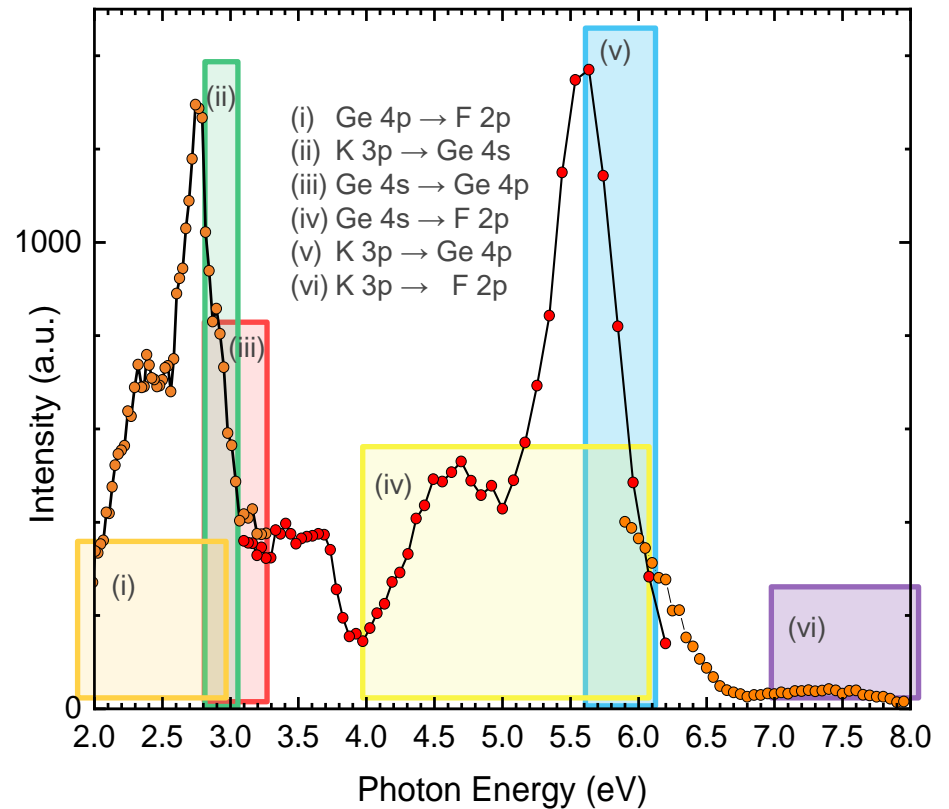
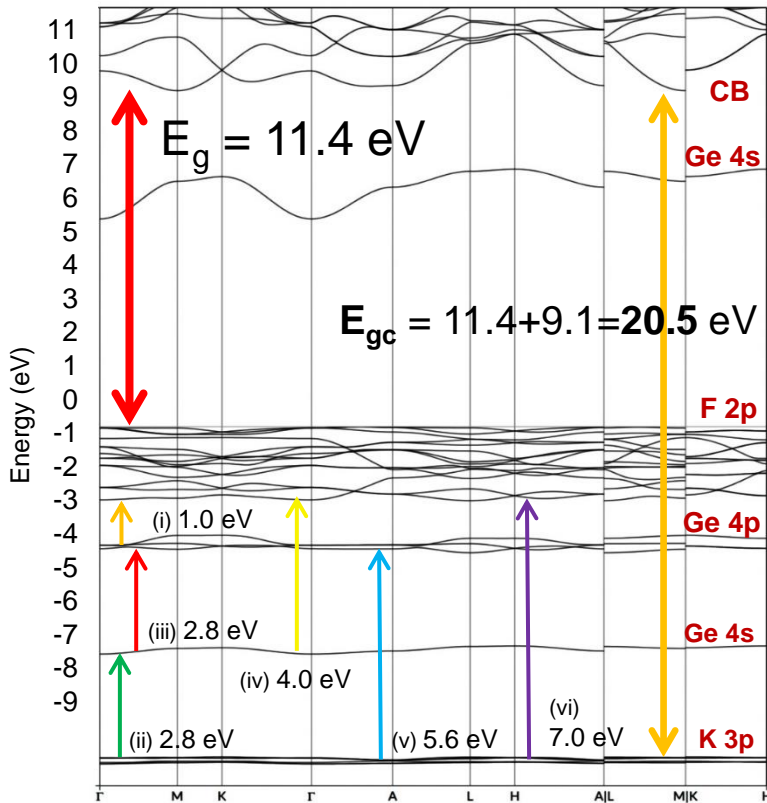
IRF 32 ps FWHM
MCP-PMT



Janis VPF-800 vedellämmastiku krüostaat

Origin of fast emissions in K_2GeF_6 single crystal

TR Luminescence in time window $\Delta TW=6$ ns at P66

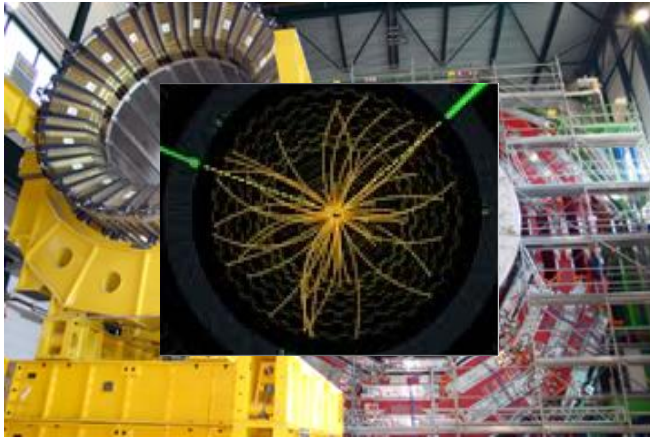


Aflow repository, afloplib.org

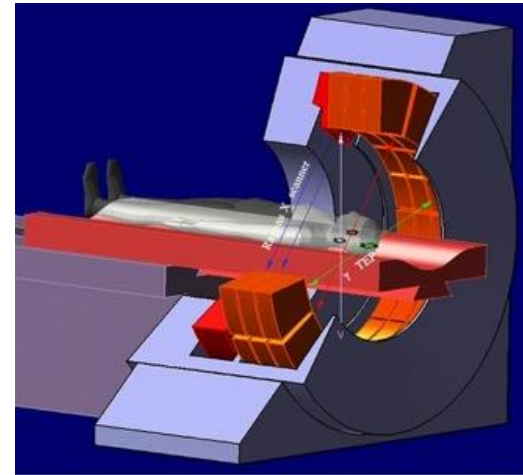
J. Saaring, *et al.*, *J. Alloys Compd.* **883** (2021) 160916.

J. Saaring, *et al.*, *J. Luminescence* **244** (2022) 118729

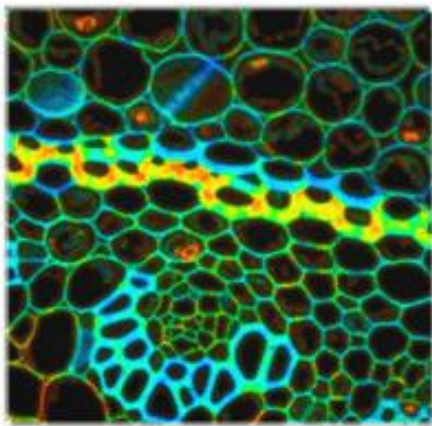
Ülikiirete stsintillaatorite detektorite võimalikud rakendused



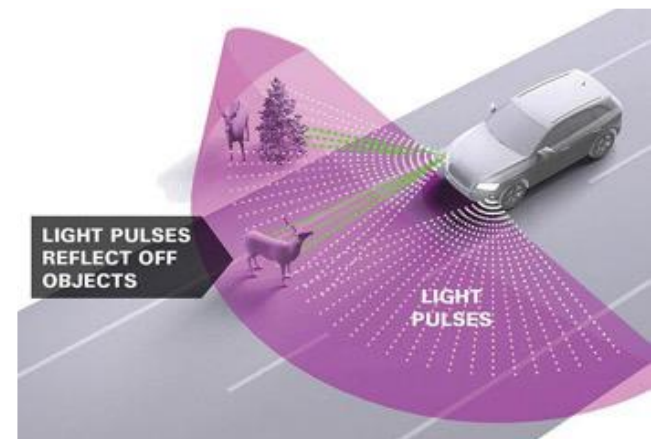
Teadusuuringud



Meditsiiniline kuvamine



Fluorestsents eluea-mikroskoopia



Lidar



Ülikiirete luminesentsnähtuste uuringud

J. Saaring, A. Vanetsev, K. Chernenko, *et al.*, *Time-resolved luminescence spectroscopy of ultrafast emissions in BaGeF₆*, *J. Luminescence* **244** (2022) 118729.

Uute oksiidsete LED fosfooride uuringud

T. Jansen, J. Gorobez, **M. Kirm**, *et al.* *Narrow Band Deep Red Photoluminescence of Y₂Mg₃Ge₃O₁₂:Mn⁴⁺,Li⁺ Inverse Garnet for High Power Phosphor Converted LEDs*, *ECS Journal of Solid State Science and Technology*, **7** (2018) R3086-R3092

Väikese raadiusega eksitonide vastasmõju suurtel ergastustihedustel

M. Kirm, V. Nagirnyi, E. Feldbach, *et al.*, *Exciton-exciton interactions in CdWO₄ irradiated by intense femtosecond VUV pulses*, *Phys. Rev. B.* **79** (2009) 233103.

Haruldaste muldmetallide ioonidel põhinevad optiliste materjalid

I. Romet, É. Tichy-Rács, K. Lengyel, *et al.*, *Interconfigurational d-f luminescence of Pr³⁺ ions in praseodymium doped Li₆Y(BO₃)₃ single crystals*, *J. Luminescence* **265** (2024) 120216

Elektronergastused madaladimensionaalsetes ja nanomõõtmelistes ainetes

J. Aarik, H. Mändar, **M. Kirm**, L. Pung, *Optical Properties of HfO₂ Thin Films Grown by Atomic Layer Deposition*, *Solid Thin Films* **466** (2004) 41-47.

M. Kirm, J. Aarik, M. Jürgens, I. Sildos, *Thin films of HfO₂ and ZrO₂ as potential scintillators*, *Nucl. Instr. Methd. A* **537** (2005) 251-255.



Rahvusvaheline koostöö

- Suured uurimiskeskused DESY PHOTON SCIENCE, MAX IV LAB, BESSY
- *Laserlab Europe* võrgustik CEA Saclay, Vilniuse Ülikooli laserikeskus
- TWINNING *EXANST* – MAX IV Lab, FZ Jülich, Imperial College (London, UK) - 2024
- *Crystal Clear Collaboration* CERN-s EESTI on täisliige 2024

Innovatsioonialane koostöö

- Science Link 2012-2014
- Baltic Tram 2016 -2019
- Carots 2019 -2022



Magistri-, doktoriõppe ja teadustaristu arendamine

Doktorikool „Funktsionaalsed materjalid ja tehnoloogiad“ 2004 -
Doktorikoolide korraldus ASTRA meetmes
Tuumaohutuse magistriõppekava arendamine

- Physikum 2014

Eesti teadustaristu teekaardil:

- Nanomaterjalid uuringud ja rakendused (NAMUR)
- Eesti kiirekanal MAX IV sünkrotronkiirguse allikale
- ESS- Euroopa neutronkiirguse allikas
- Eesti osalus Euroopa Tuumauuringute Keskuses CERN



Eesti teaduste akadeemia energeetikakomisjon



- Euroatomi teadus ja tehnilise komitee liige
- Kogemus, koostöö ja teadmised
- Soov muuta maailma paremaks

TÜ Füüsika-keemia teaduskond 1991, füüsika laser – optika *cum laude*

PhD Lündi Ülikool 1995 juhendaja Prof. Indrek Martinson

Hamburgi Ülikool / DESY 1997-2004 Prof. Dr. G. Zimmerer

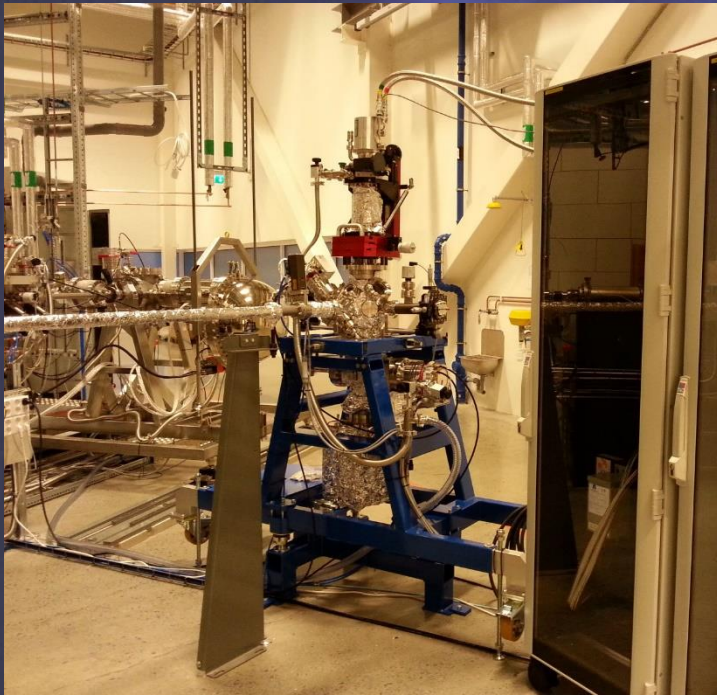
TÜ FI teadusdirektor ja direktor 2004 – 2012

TÜ teadusprorektor 2012-2017

TÜ eksperimentaalfüüsika professor 2017 -

Marco.kirm@ut.ee +372 5342 7170

Aitäh !



FinEstBeAMS at MAX IV Lab
