Unexplored sub-picosecond dynamics in matter under extreme conditions

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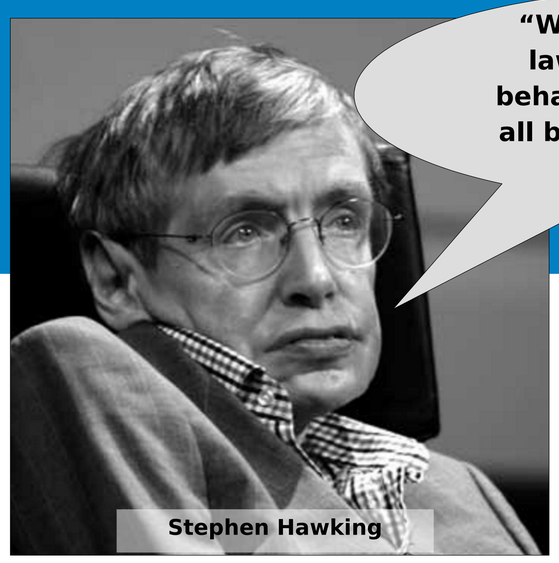
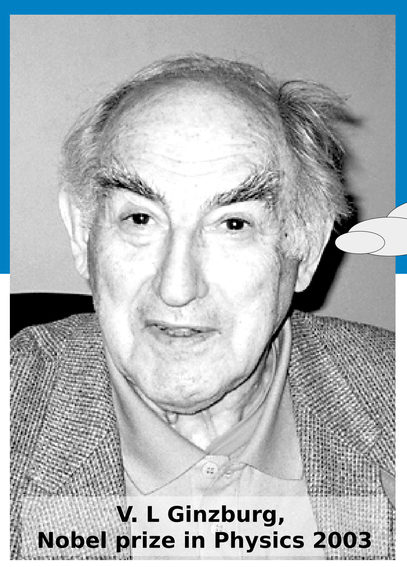
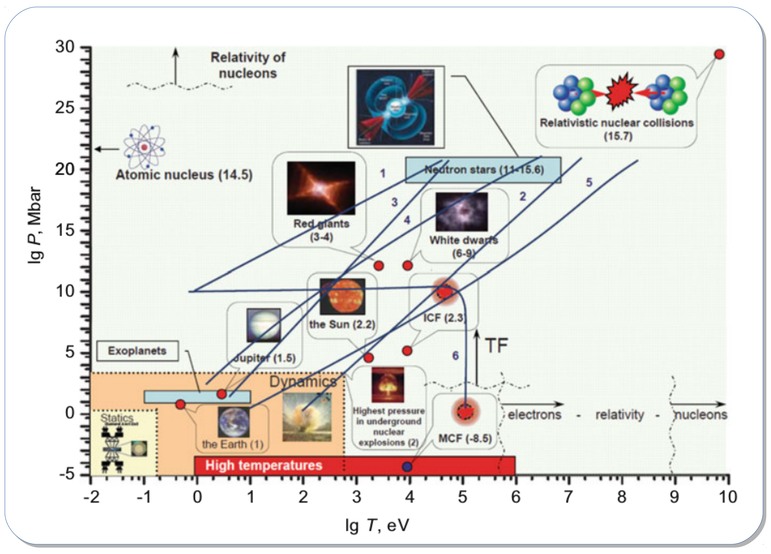


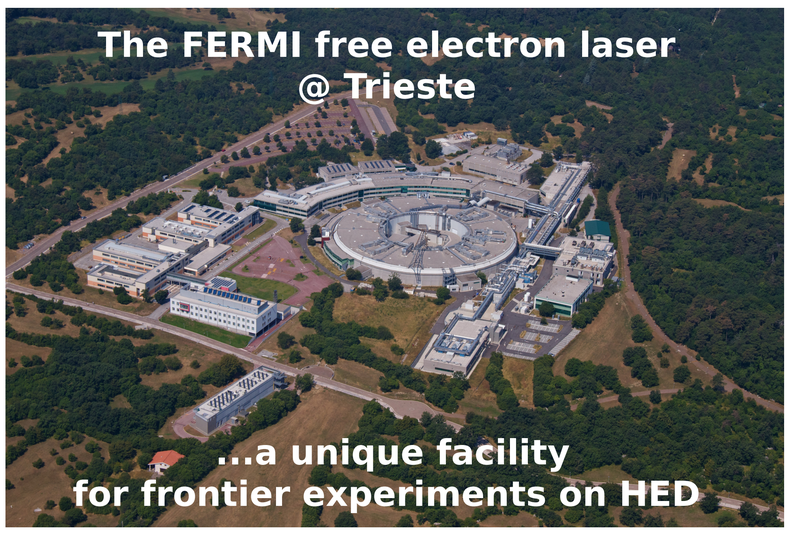


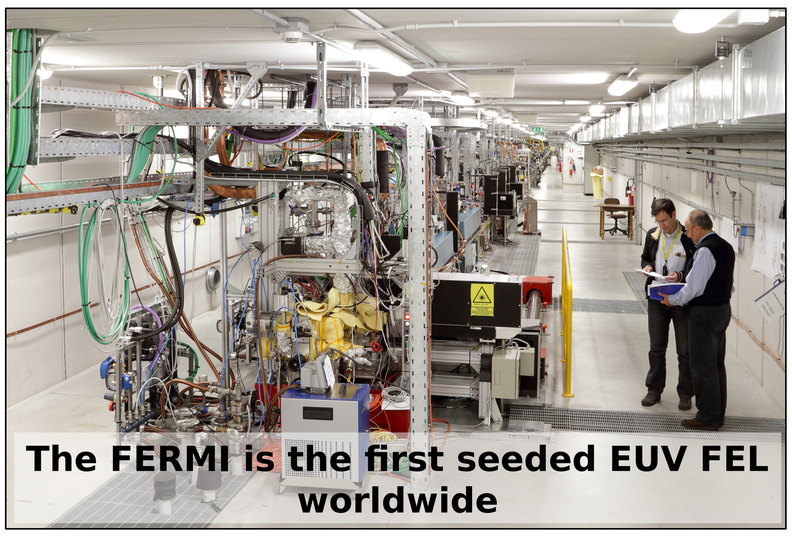
	Pressure	Temperature	Density
Mariana Trough	1.2 kbar	...	...
Earth’s center	3.6 Mbar	0.5 eV	10–20 g/cm^3
Jupiter’s center	40-60 Mbar	2 eV	30 g/cm^3
Sun’s center	240 Gbar	1.6·10^3 eV	150 g/cm^3
Inertial plasma confinement	200 Gbar	10^8 eV	150-200 g/cm^3
White dwarfs	10^4-10^9 Tbar	1.6·10^3 eV	10^6–10^9 g/cm^3
Neutron stars	10^{13}-10^9 Tbar	10^4 eV	10^{11} g/cm^3
LHC	10^{18} Tbar	10^{10} eV	10^{16} g/cm^3

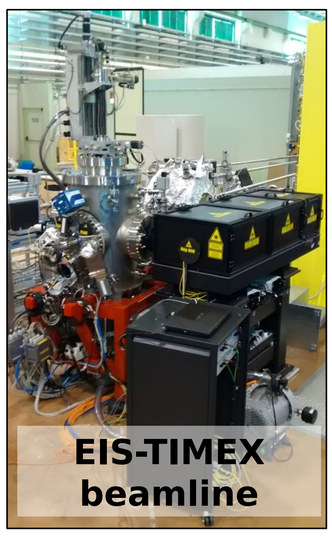
1 eV = 11605 K

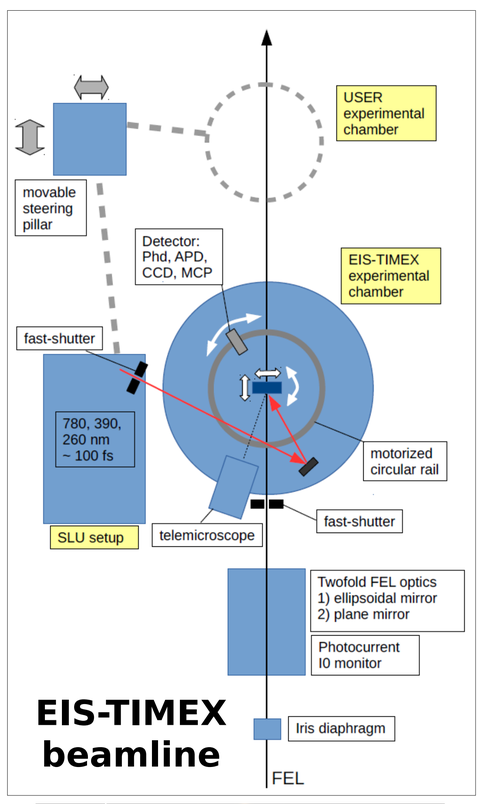
- High energy densities (HED) ← → high temperatures and densities ← → extreme conditions
- Recent outstanding experiments revealing the Higgs Boson and the gravitational waves were associated with high-energy-density events
- Extreme conditions:
  - energy densities exceeding 10^4 –10^5 J/cm^3 (typical binding energy of condensed matter)
  - pressure level of Mbar
- The major part (90–95 %) of baryon (visible) matter in Universe is under extreme conditions

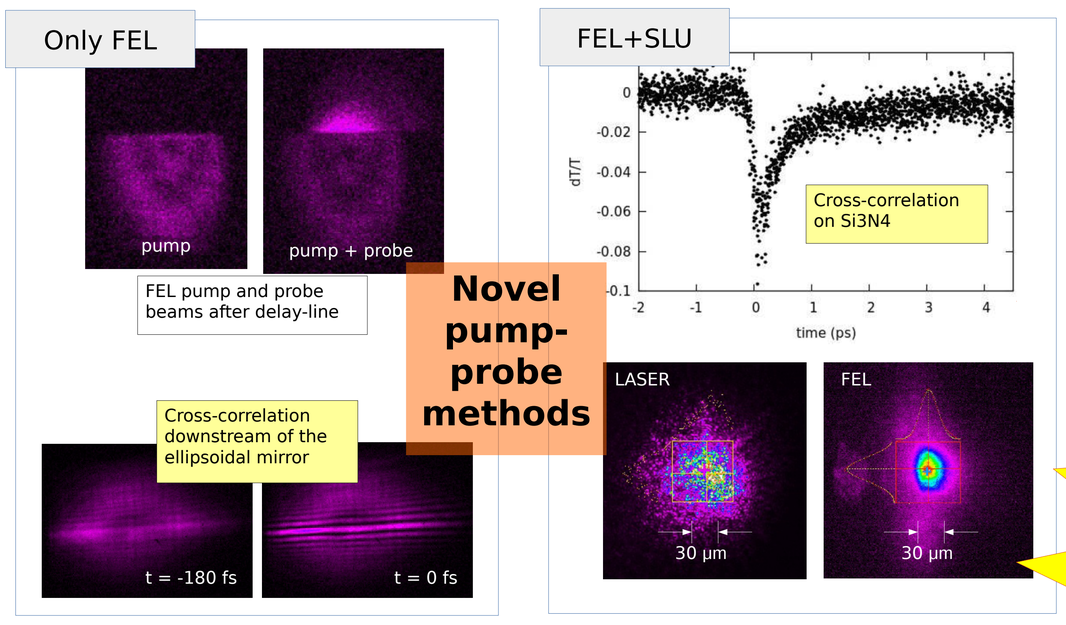


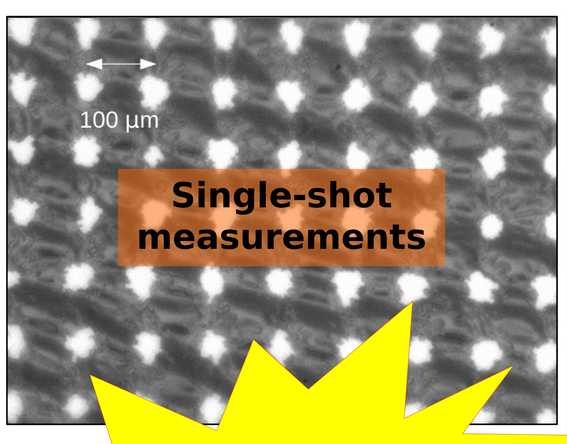




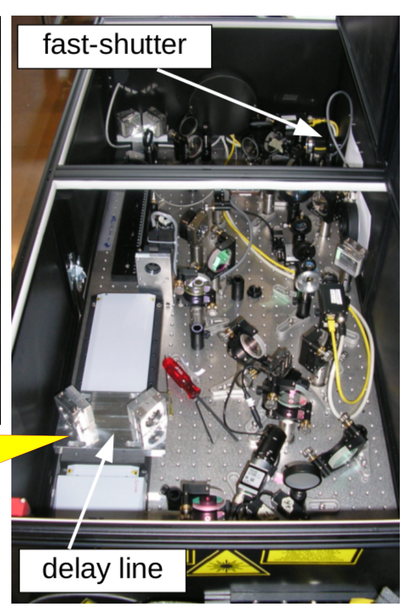


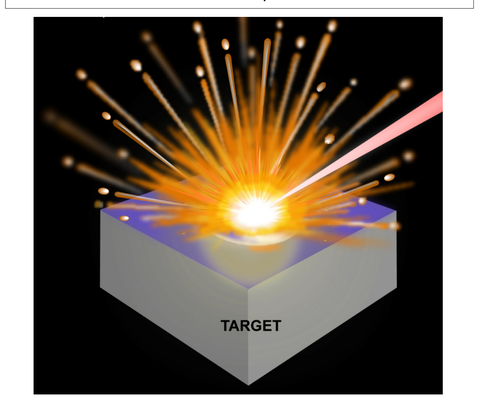


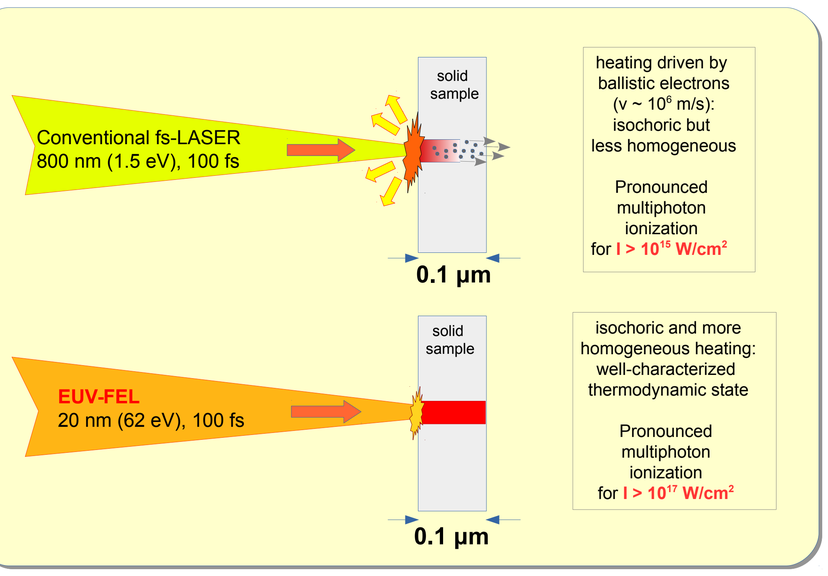


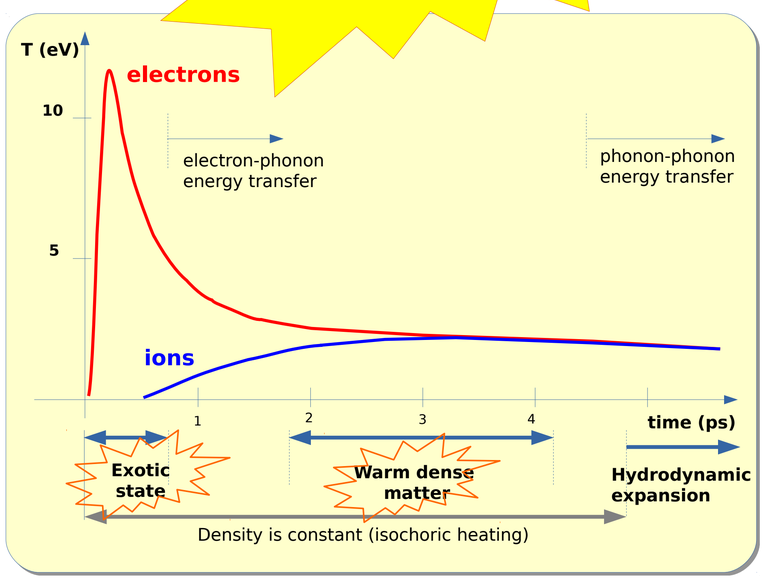


Unprecedented experiments on HED matter









This research is aimed at

1) extending our knowledge of the laws that govern the Universe

2) accelerating the development of the inertial confinement fusion technique for production of clean nuclear energy