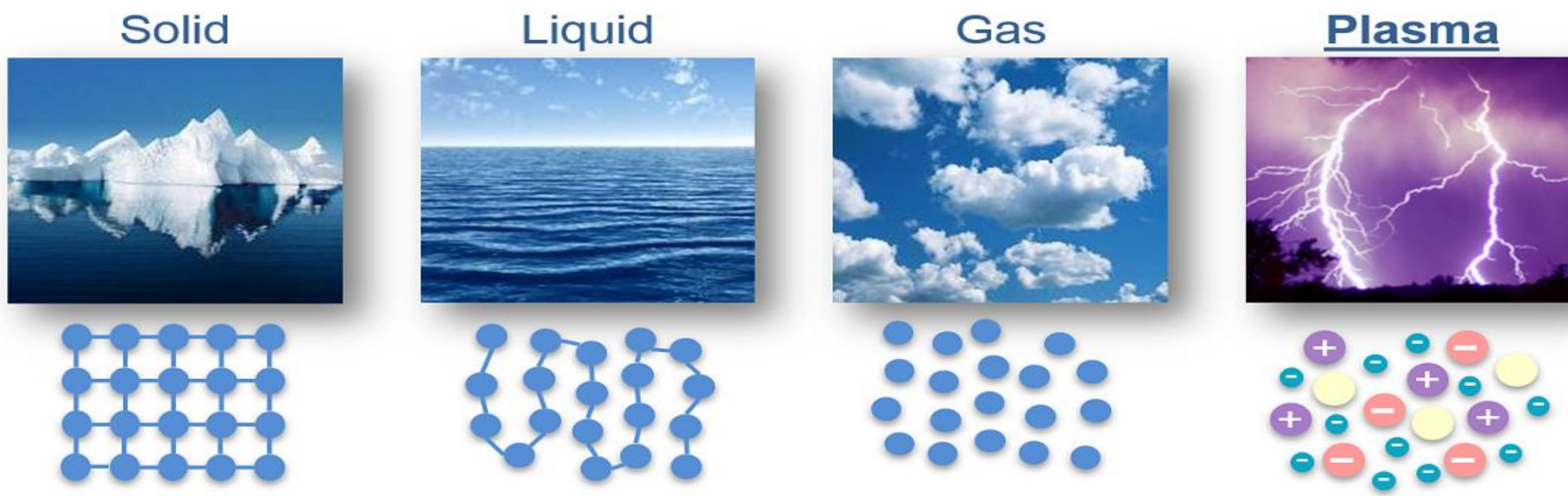


PLASMA : WHAT IS PLASMA ?



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The 4th State of Matter



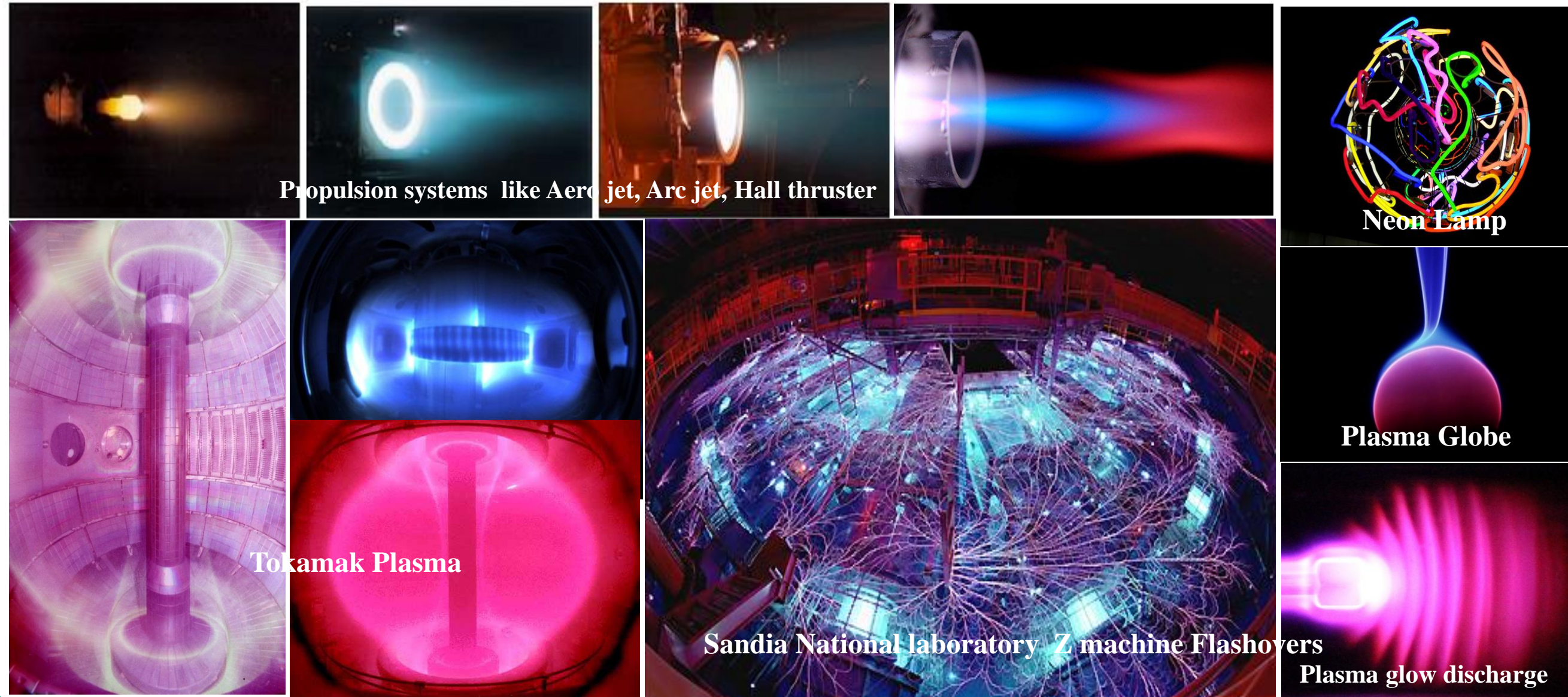
□ Observable matter exists in four forms: Solids, Liquids, Gas and Plasma □ Plasma, the 4th State, is the highest energy state of the matter. □ Matter attains its different forms depending upon the energy levels it has reached □ On continuous heating / energising to higher levels Solids turn to liquids, Liquid to gas and gas into to plasma state. □ Plasma state is that condition where electrons and atomic constituents have gained sufficient energy to remain disassociated from one another. □ Depending upon the degree of ionization plasma are varied as mix of (a) electrons and Ions (b) electrons and protons and neutrons (c) Electrons and nucleons etc. □ In the absence of sufficient sustaining power plasma constituents recombine to form neutral gas □ Plasma consists 99 % of the observable universe. 90% of the mass of the universe is considered to be contained in "dark matter" composition and state of which are still unknown. □

Plasma in Nature

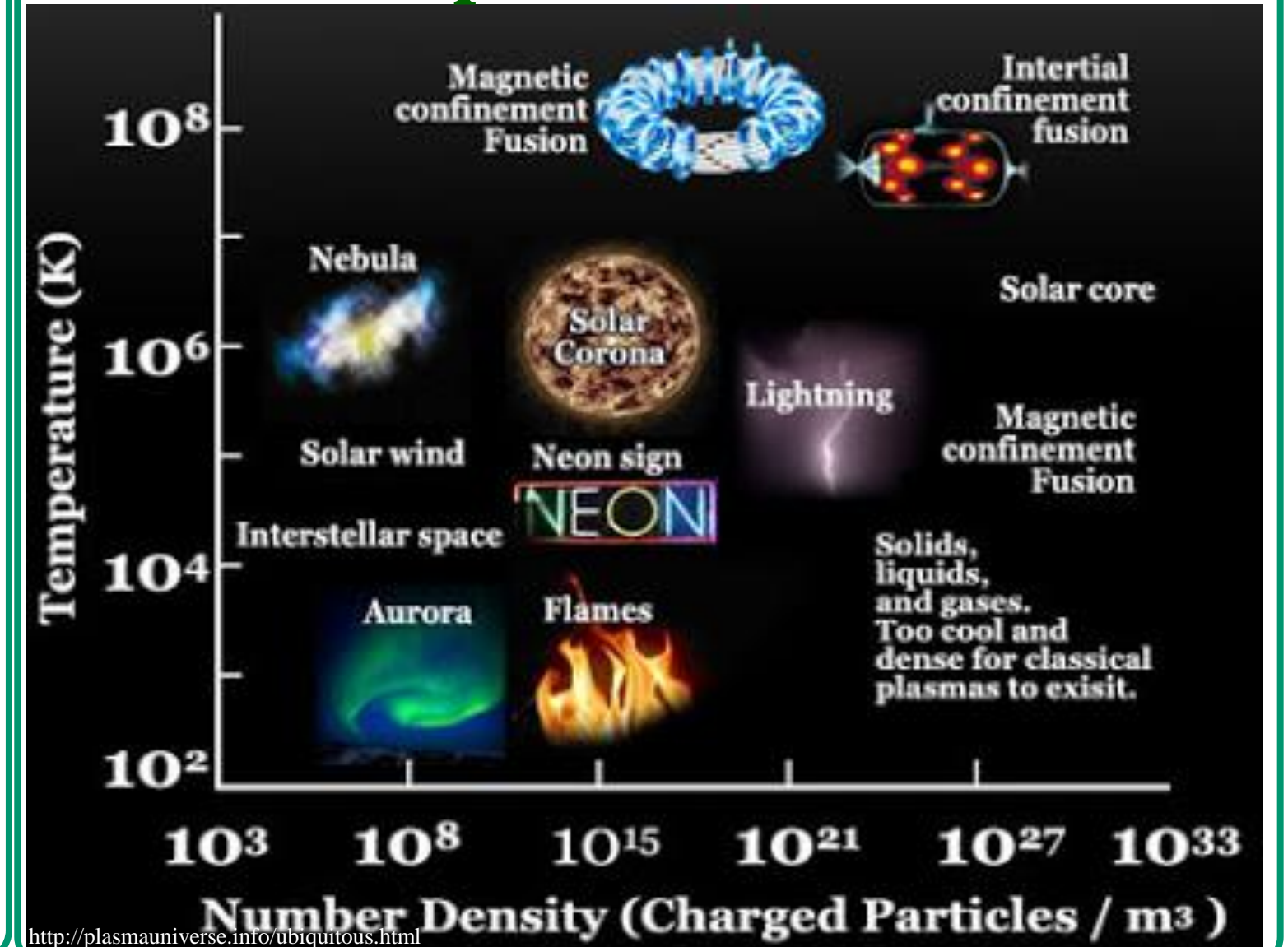


□ Natural occurrence of Plasma in normal terrestrial conditions is not common. Auroras observed at the northern and southern hemispheres of earth and the lightening streams are such natural plasma. Stars including Sun and the interstellar gases are all in plasma state.

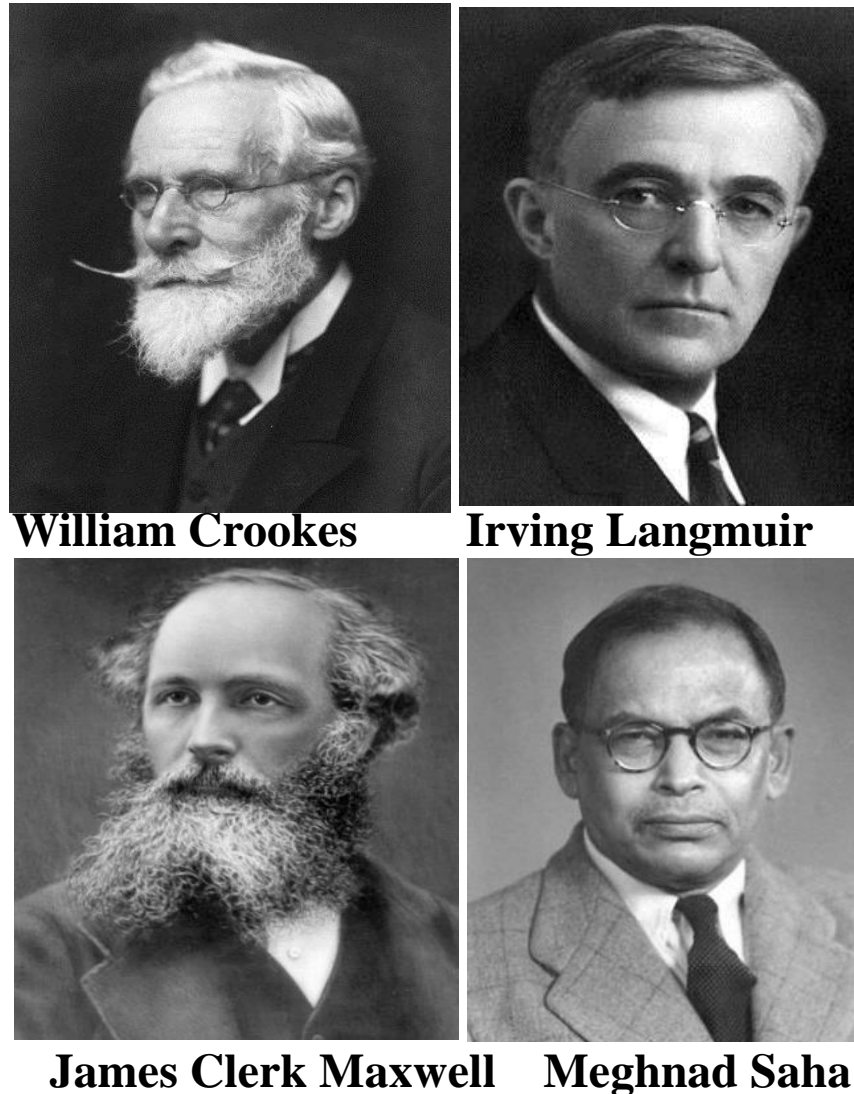
Man Made Plasmas



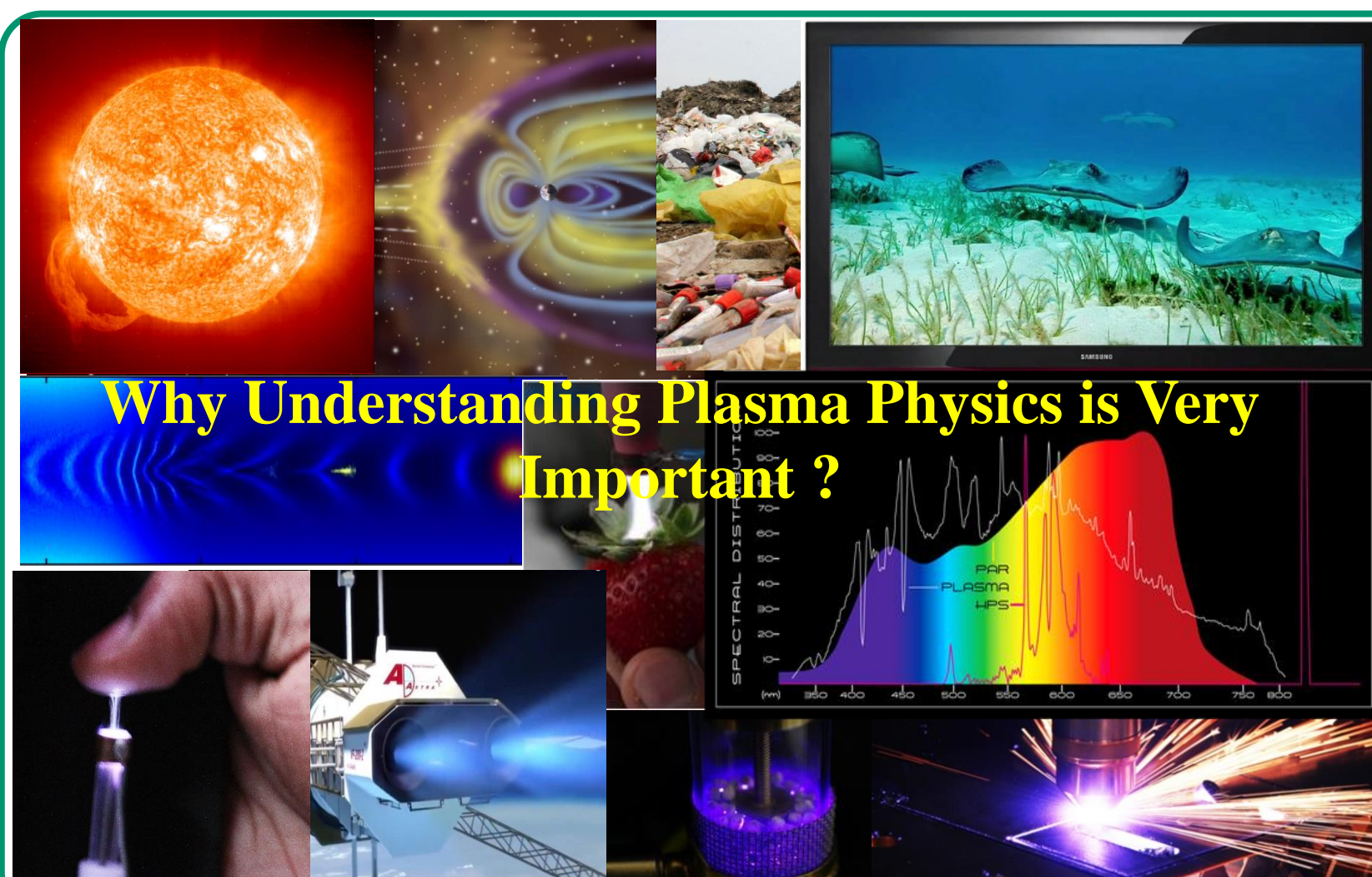
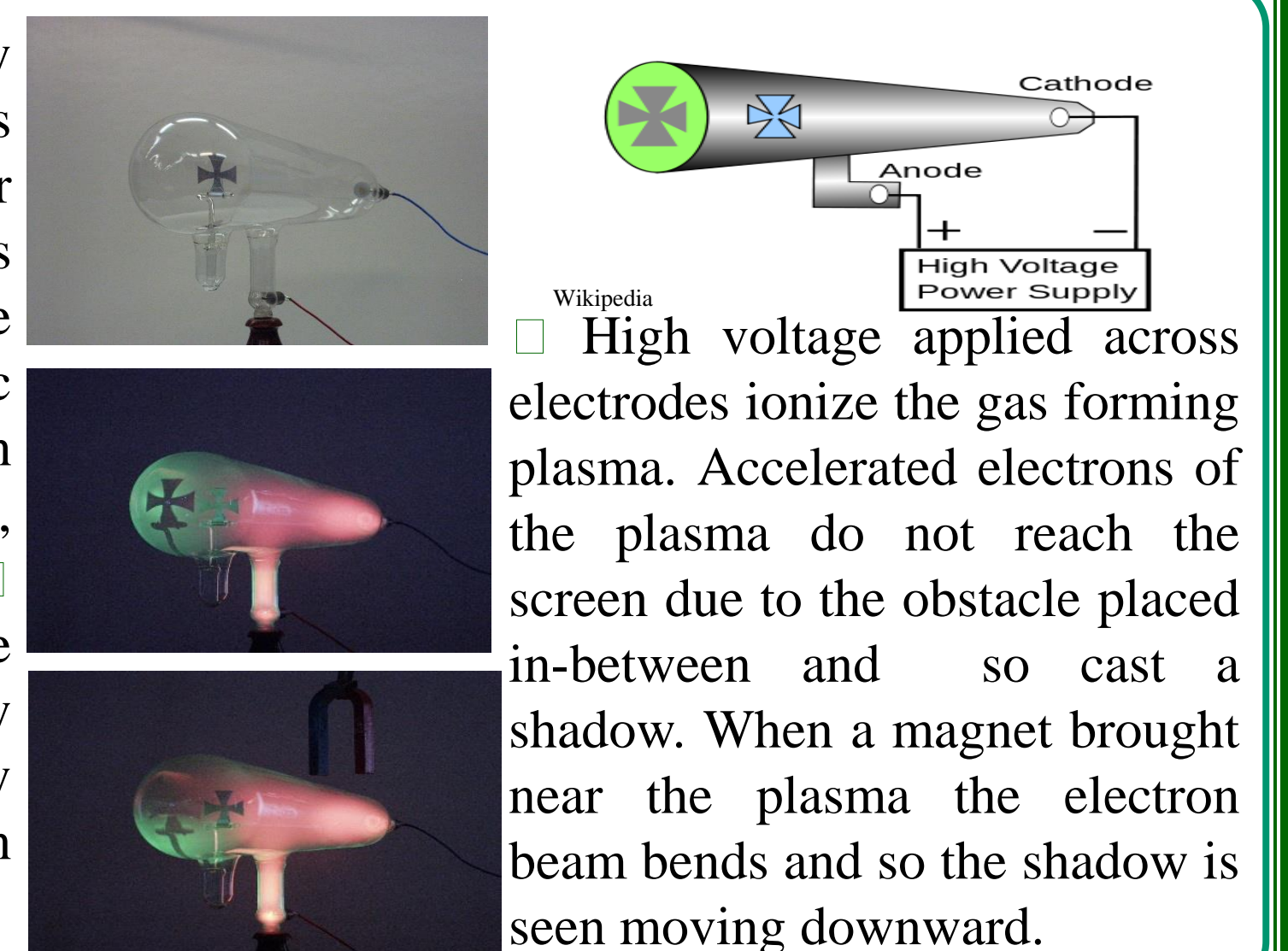
Plasma Temperatures and densities



Historical
□ Sir William Crookes identified plasma as a state of matter in 1879.
□ In 1929, Nobel Laureate Irving Langmuir gave the name, plasma, as it resembled blood plasma which has many constituents. □ James Clerk Maxwell and Hendrik Lorentz Electromagnetic theories and forces gave basic explanation to plasma characteristics. □ Prof. Meghnad Saha and Hendrik Lorentz laid the foundation in understanding the complexity of plasma and its behaviour. □



□ Crooks Tube invented by Sir William Crookes is considered as the first ever plasma device □ This System demonstrated the production of plasma, basic observable characteristics in magnetic and electric fields, the diffusion process etc. □ This invention led to the discovery of Cathode ray tube displays and many related devices, generation of X-Rays etc.. □



Why Understanding Plasma Physics is Very Important ?

□ A medium for near endless source of energy and research in frontiers of science in understanding nature and universe,
□ Food production and storage, solid waste management, space exploration and travel
□ Engineering Industrial applications and manufacturing process □ Environmental protection and safeguards



□ **Physics** has generated new avenues of basic sciences. Studies in turbulence have contributed for safe air travel. Extremely cold plasmas that condense to crystalline states are new discoveries. Laser-plasma interactions and table-top high energy particle accelerations have enormous applications. plasma chemistry and plasma-surface interaction based industrial processes are on the anvil. Plasma medicine is another fast emerging area.