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SIX STATES OF MATTER

Four states of matter are well known: solid, fluid, gaseous and plasma. All of these are thermal states: their particles have the heat motion i.e. motion in all 3 possible dimensions. The energy of this heat motion produces these four thermal states of matter - in relation to the attractive electric forces among their particles e.g. in ice-crystal or water. But the 20th century did not answer following questions:

- Is there another state of matter which is more energetic than plasma?
- How can we explain the cosmic rays up to particle energies of 10^{21} electronvolt?
- Filaments of the solar corona seem to be very hot without clear heating process, why?
- Why are filaments and jets so very thin – as recently discovered?
- Why did SOHO not find the solar dynamo (its most important goal)?
- **How many states of matter are theoretically possible?**

One of the states of matter is the Bose-Einstein condensate. It has zero thermal-energy. We should give the number zero to it (table below); also because of its proximity to the 0K. Its popular name of the "fifth state of matter" is clearly incorrect since heated plasma will never be transformed to this Bose-Einstein condensate.
Taking this into consideration, the filaments should belong to "the fifth state of matter". Sparks, electron beams in TV, lightnings, ion jets in the spacecraft Deep Space 1, in accelerator machines like CERN, ions in the future fusion-reactor, solar coronae, flares, jets of young stars, jets at black holes and at neutron stars (electric magnetars) belong to this most energetic state of matter. Solar flare-particles have 10^{10} eV, those of the hottest plasma (in supernovae) only 10^5 eV. Filaments are the largest bodies of the Universe. These filaments and jets have an exact circular cross section, can oscillate and are produced electrically from e.g. plasma. Its particles move in only one direction i.e. without the thermal zig-zag. The fifth state of matter is also a non-thermal state! Interestingly, particles in the most energetic state of matter do not emit heat due to their flight along straight lines. These particle-motions in filaments were already named recently: "non-thermal motions". For example, the solar wind has a "non-thermal velocity" of 750km/s which would need a solar surface of 24 million Kelvin. Solar mass ejection of a "non-thermal velocity" of 1500 km/s should have 96 MK.

Matter belongs to one of the following 6 states of matter due the energy of its particles:

	0	1	2	3	4	5
name:	Bose-Ein.	solid	liquid	gaseous	plasma	filament
energy:	~zero	<crystal	<attraction	>attract.	$<10^5$ eV	$<10^{26}$ eV
character:	non-thermal	thermal	thermal	thermal	thermal	non-thermal
particle-motion	no motion	particles move in all three dimensions				motion in only one direction

The theoretic category, in which particles move in two dimensions, is impossible, because such bodies cannot exist. They would have zero volume. Plasma particles above 10^5 eV cannot exist because hypernovae cannot exist. Filament-particles above 10^{26} eV cannot exist. The largest neutron stars of three sunmasses have only 10^{26} V. The energy of the particles has an upper limit in all states of matter. Therefore, very probably, **the Universe has these six states of matter, not more and not less.**