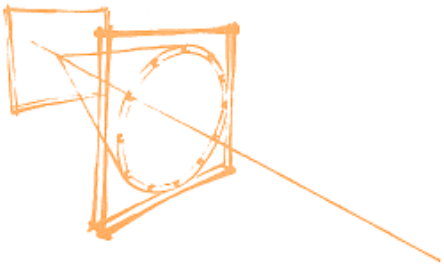

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# The use of saturated fluorocarbon fluids in high energy physics

*jeudi 6 mai 2010 09:00 (30 minutes)*

The excellent dielectric properties of saturated (CnF(2n+2)) fluorocarbons have allowed their use in direct immersion liquid cooling of electronics, for example in the Cray series supercomputers. They have also found extensive use as heat transfer media in vapour phase soldering.
Their high density and optical transparency led to the suggestion by Seguinot and Ypsilantis for their use as liquid and gas radiator media for RICH detectors: such fluids have now been used in numerous particle physics and astroparticle physics experiments, some of which are highlighted.
Systems to circulate and purify fluorocarbon Cerenkov radiator fluids rely on thermodynamic cycles similar to those of modern CFC-free refrigerants. Such new refrigerants - designed to disintegrate under UV in the atmosphere - are radiation-intolerant and cannot be used for direct cooling of particle detectors in demanding radiation environments such as at LHC. However pure saturated fluorocarbon molecules are extremely radiation resistant as well as being non-flammable and non-toxic. Their use as evaporative refrigerants was pioneered for the ATLAS pixel detector, leading to their choice for the cooling of the entire silicon tracker. Additionally they are used to evaporative coolants in ALICE and TOTEM and as liquid coolants in ATLAS and CMS.
Ultrasonic techniques for vapour phase analysis of fluorocarbon Cerenkov radiators - developed at SLAC during the 1980s as an inexpensive and simple alternative to UV refractometry - have found use in the petrochemical industry, in the MOCVD (metal organic chemical vapour deposition) manufacture of semiconductors and have been successfully demonstrated with gas mixtures used in clinical anaesthesia. Such techniques are again under development for the ATLAS tracker evaporative cooling system.
Examples of the thermodynamics of fluorocarbon circulation systems, together with the ultrasonic analysis technique for these fluids will be described.

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plenary

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