Liquid crystalline glasses

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A liquid crystal has liquid-like fluidity and crystal-like anisotropy, a combination of properties that has enabled the current omnipresence of flat panel displays. Glasses combine mechanical robustness with the absence of pronounced grain boundaries and have therefore become the preferred state of matter for charge- and exciton-transporting as well as emitting layers in organic optoelectronic devices. The combination of the anisotropy of liquid crystals with the robustness of glasses may be beneficial for anisotropic transport and anisotropic emission to improve the performance of devices, amongst others by improving light outcoupling.

As has been shown by Mark Ediger (Madison/Wisconsin) and colleagues, glasses of low molecular weight offer the possibility to form surface-aligned anisotropic layers by controlled physical vapor deposition, without need for subsequent thermal annealing that would complicate device fabrication. PVD also allows obtaining low-entropy glasses that would otherwise require thousands of years of aging. Anisotropic alignment by PVD is observed even in normally isotropic glasses, but can be strongly enhanced in liquid crystalline glasses.

Following an introduction to these topics, I will present the synthetic efforts at the CRPP, in collaboration with Brazilian partners in Florianopolis and Salvador, towards columnar liquid crystalline glasses with a large triplet-to-ground-state band gap, to allow embedding of delayed-fluorescent emitters for anisotropic emission.