Spin Characteristics of 2d Hybrid Perovskites

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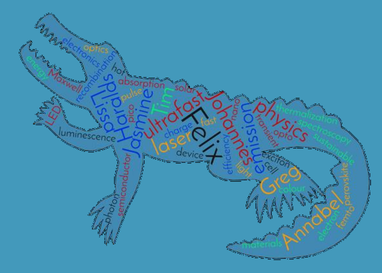
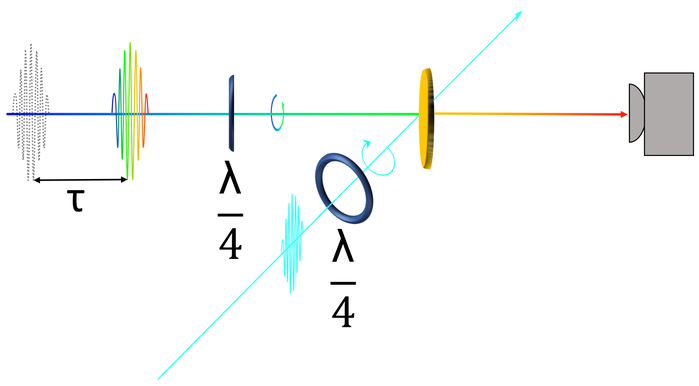


Overview:

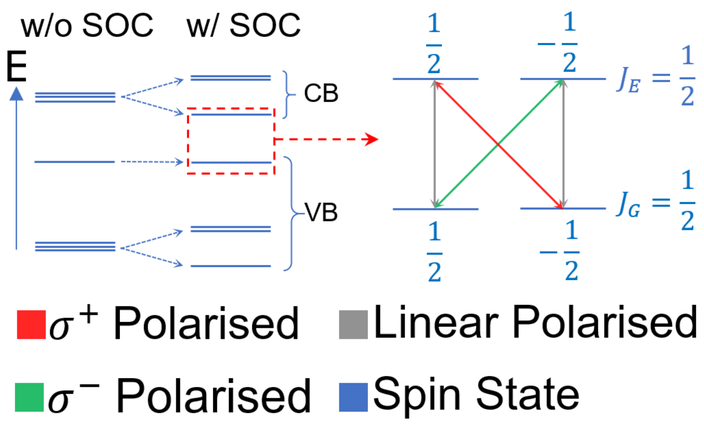
- Dresselhaus and Rashba splitting previously reported in 3d and 2d perovskites.(1,2)
- We present circularly polarised ultrafast broadband transient absorption measurements on 2d hybrid perovskites.
- Spin relaxation lifetimes up to 3.1ps.
- We determine that the momentum space band splitting does not originate from the dipole moment of organic cations.

Measurement



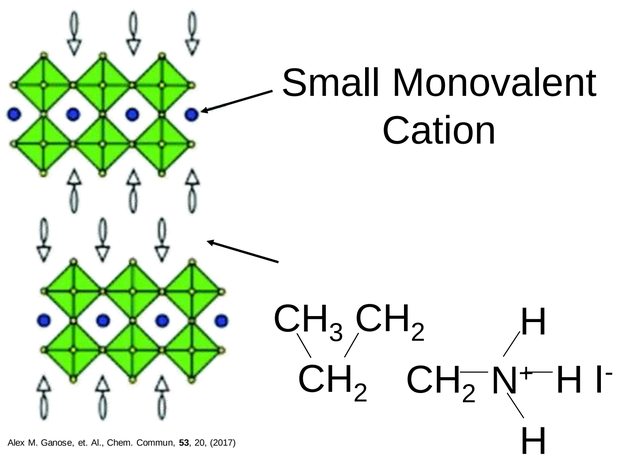
- Pump excites electrons.
- Absorption modified by excited carriers: Pauli blocking.

- Reduced to a four level system by spin orbit coupling.(3)
- Selection rules restrict possible transitions.



$$\Delta m_j = \begin{cases} 1 \text{ for } \circlearrowleft \\ -1 \text{ for } \circlearrowright \end{cases}$$

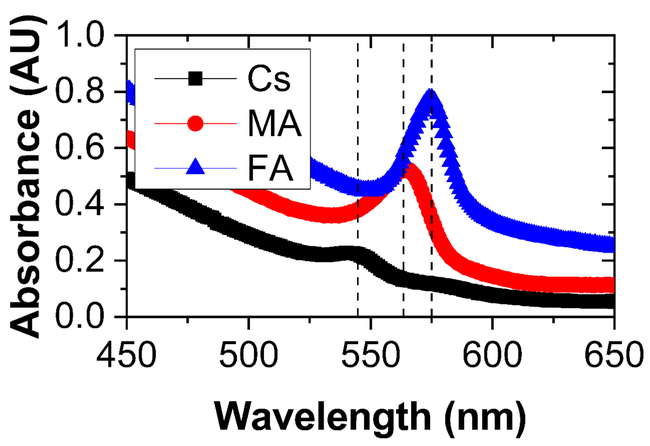
2d Perovskite



Alex M. Ganose, et. Al., Chem. Commun, **53**, 20, (2017)

Monovalent cation	Dipole moment
MA+	2.22 D
FA+	0.19 D
Cs+	--

n-butylammonium iodide



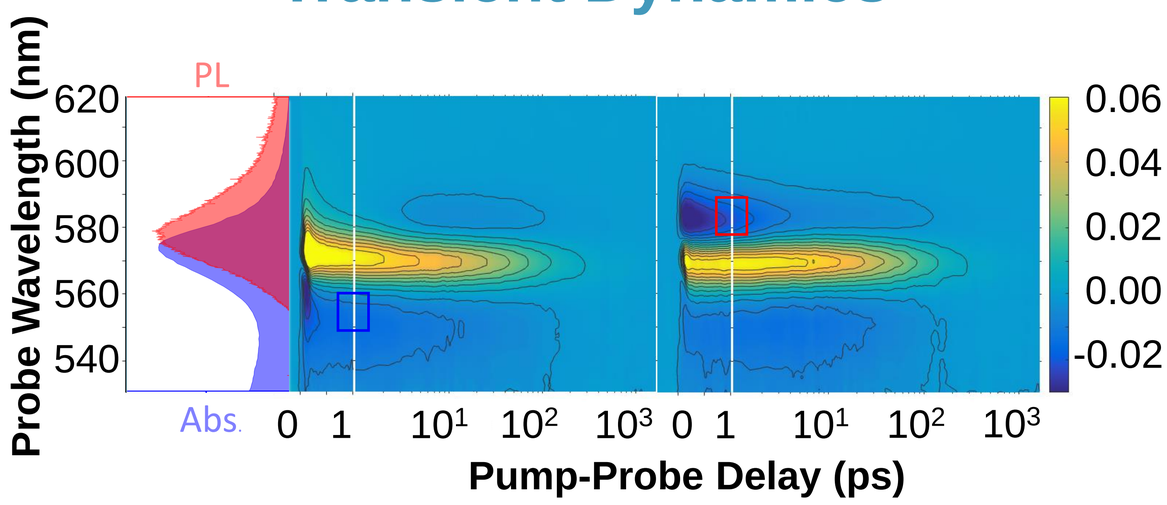
- Large organic cations isolate octahedral layers.(5)
- Quantum confinement modifies optoelectronic properties.
- Is the dipole moment of small cation the origin of band splitting?

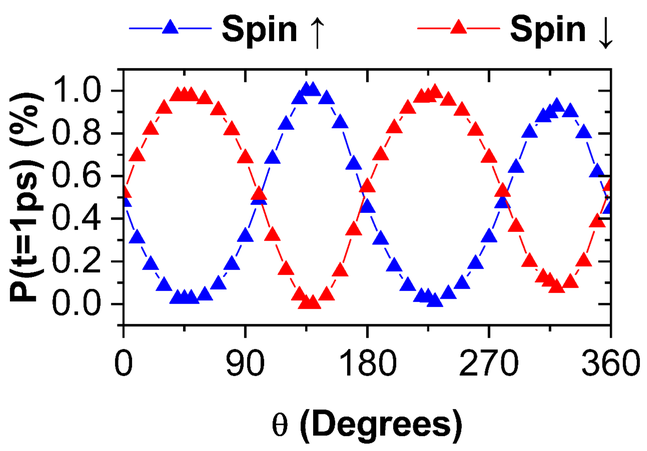
Fabrication

- Solution processable.
- Tuneable choice of cation's and anion.
- Tuneable control of number of lead halide octahedral layers, n.

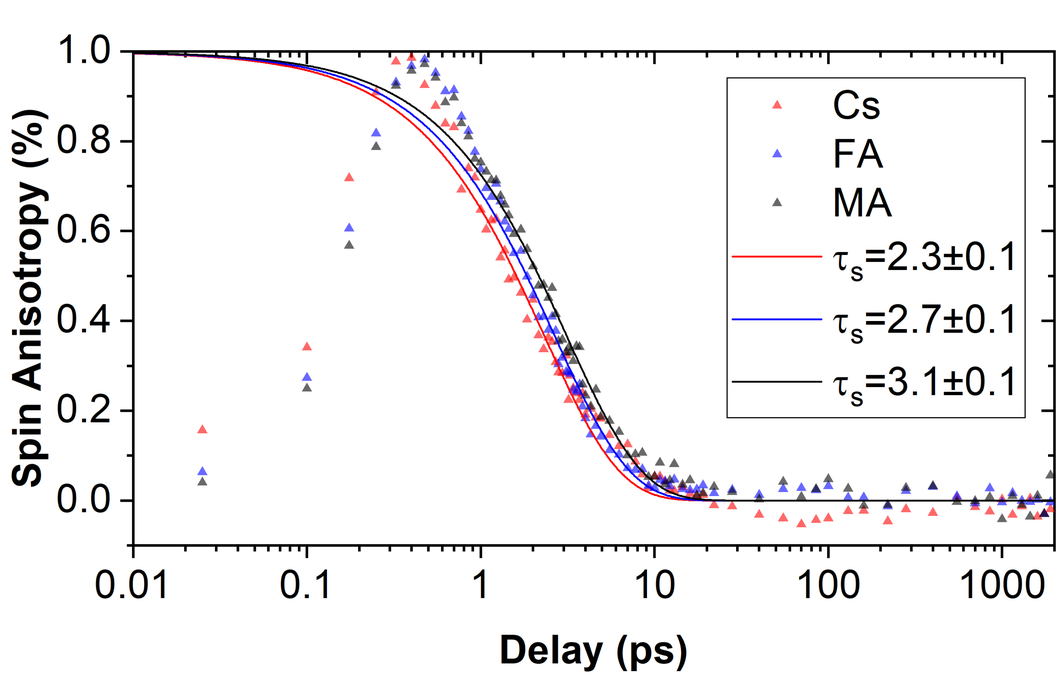
$$(CH_3(CH_2)_3NH_3)_2(CH_3NH_3)_{n-1}Pb_nI_{3n+1}$$

Transient Dynamics





- Optically addressable spin states.
- Band splitting likely enhanced by the cation dipole.(6)



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