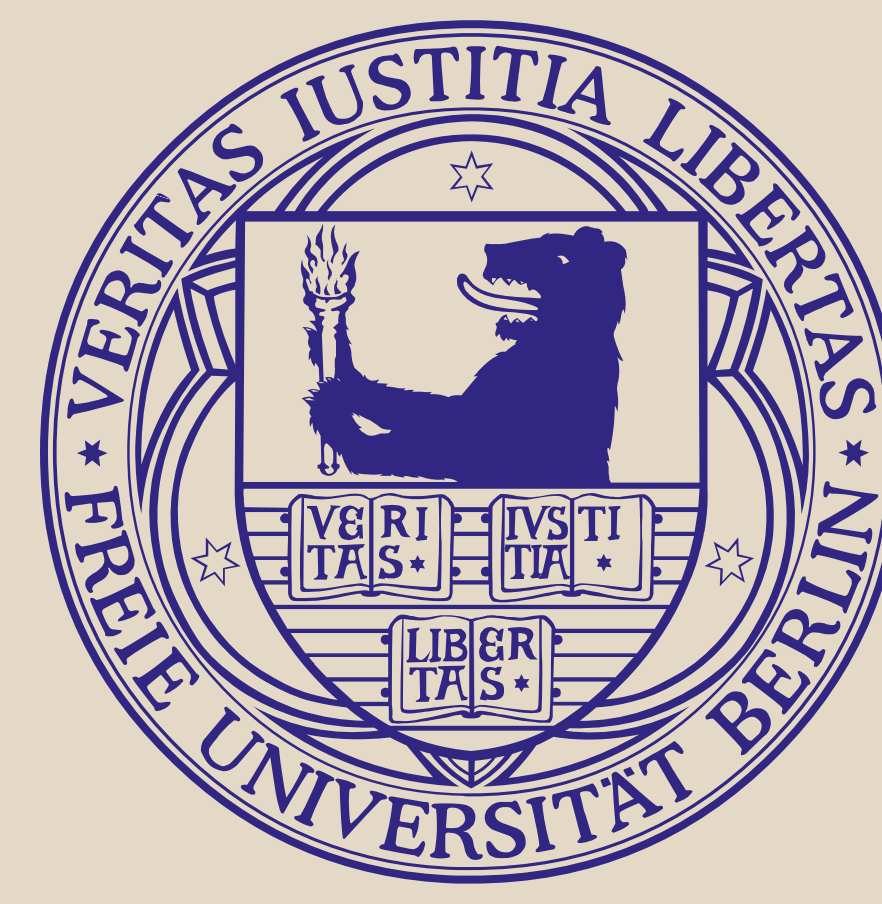


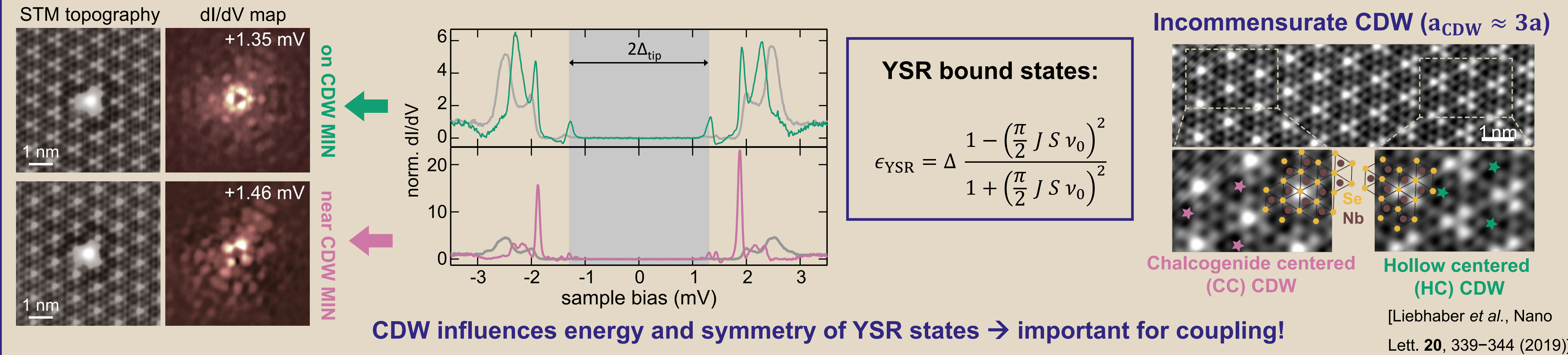
Coupling of Yu-Shiba-Rusinov states in the presence of a charge-density wave

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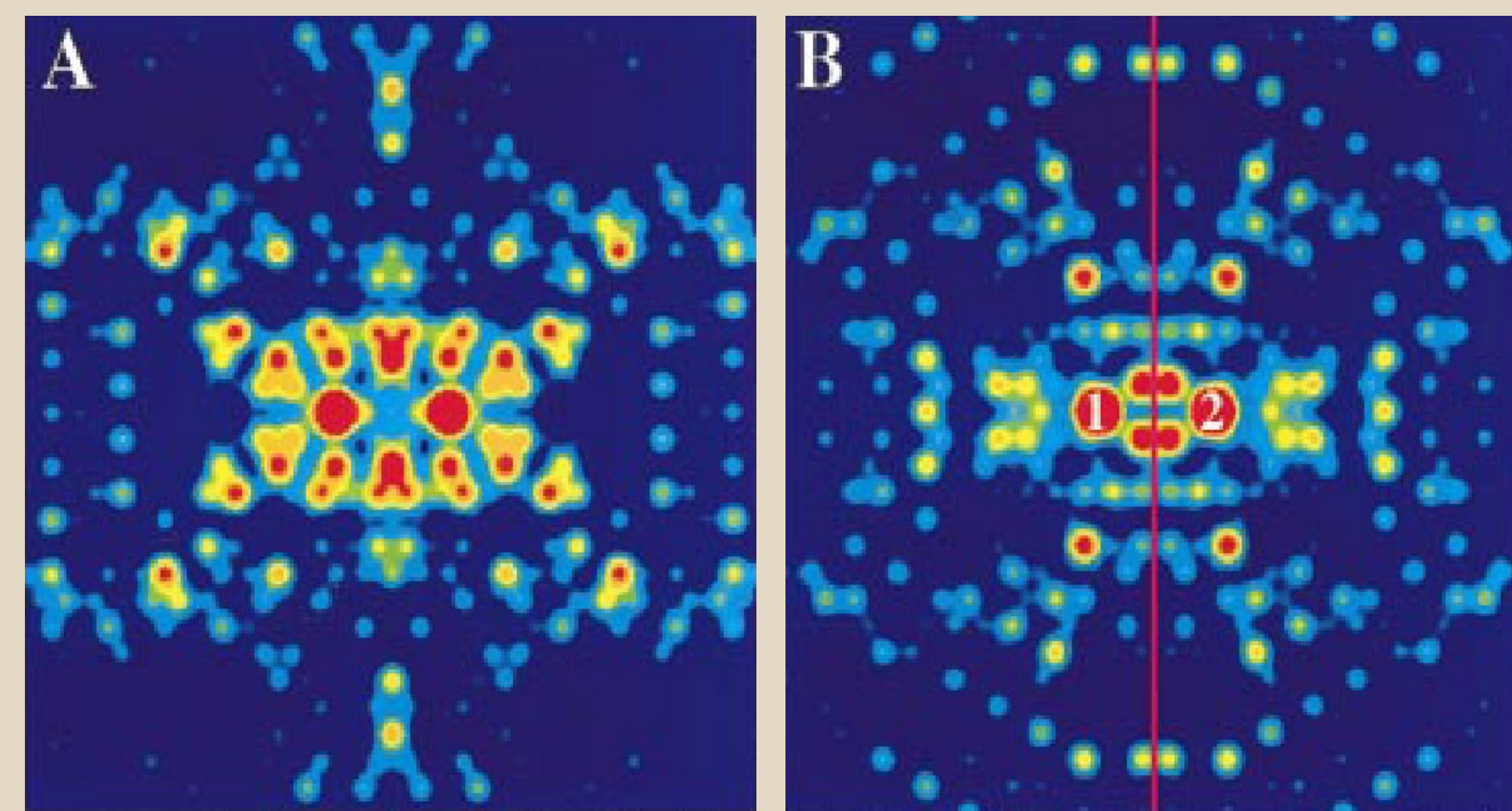
¹Fachbereich Physik, Freie Universität Berlin, ²Dahlem Center for Complex Quantum Systems and Fachbereich Physik, Freie Universität Berlin, ³Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, ⁴Ruprecht-Haensel-Labor, Christian-Albrechts-Universität zu Kiel, ⁵Deutsches Elektronen-Synchrotron DESY, Hamburg

Single Fe atoms and the charge-density wave



Theory – Hybridization of YSR states

Splitting in symmetric & antisymmetric combination



→ Complex patterns on NbSe₂

[Flatté *et al.*, Phys. Rev. B **61**, 14810 (2000)]

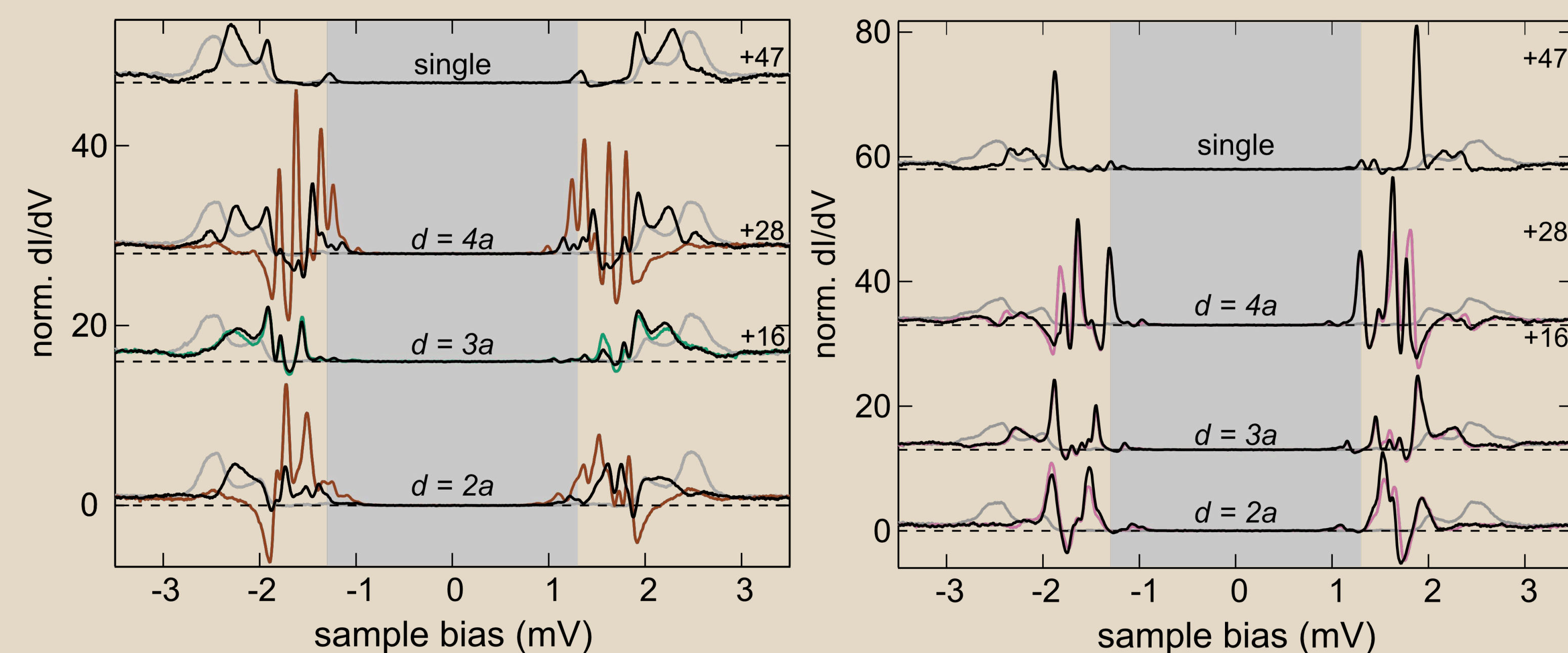
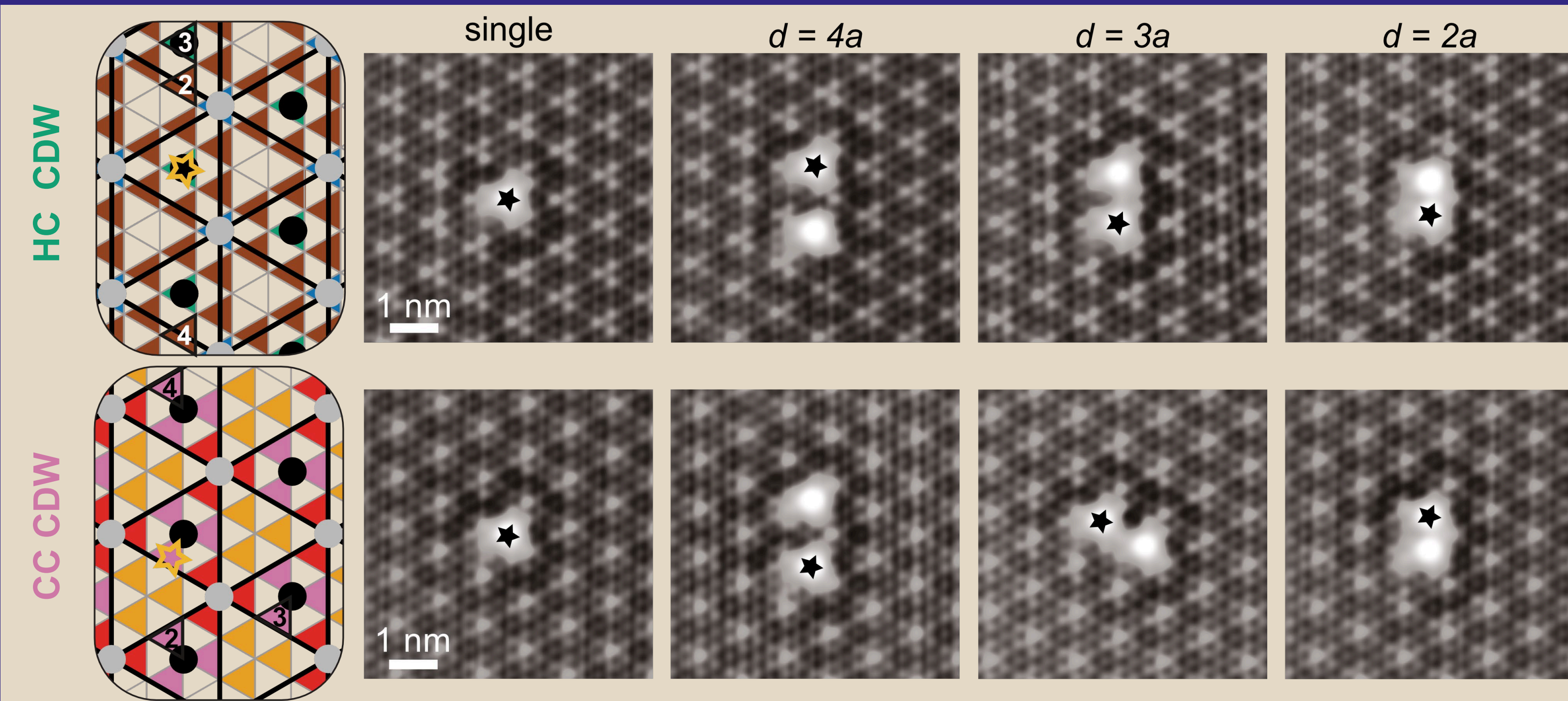
$$\epsilon_{\pm} = \epsilon_{\text{YSR}} + \frac{C \pm D}{1 + S}$$

$C_{kl} = \langle \psi_k | J_l | \psi_k \rangle$: Coulomb interaction
 $D_{kl} = \langle \psi_k | J_k | \psi_l \rangle$: Exchange interaction
 $S_{kl} = \langle \psi_k | \psi_l \rangle$: Overlap of wave functions

[Pientka *et al.*, Phys. Scr. **T164**, 014008 (2015)]
 [Ruby *et al.*, Phys. Rev. Lett. **120**, 156803 (2018)]

→ **Splitting in symmetric & antisymmetric combination as fingerprint of YSR hybridization**

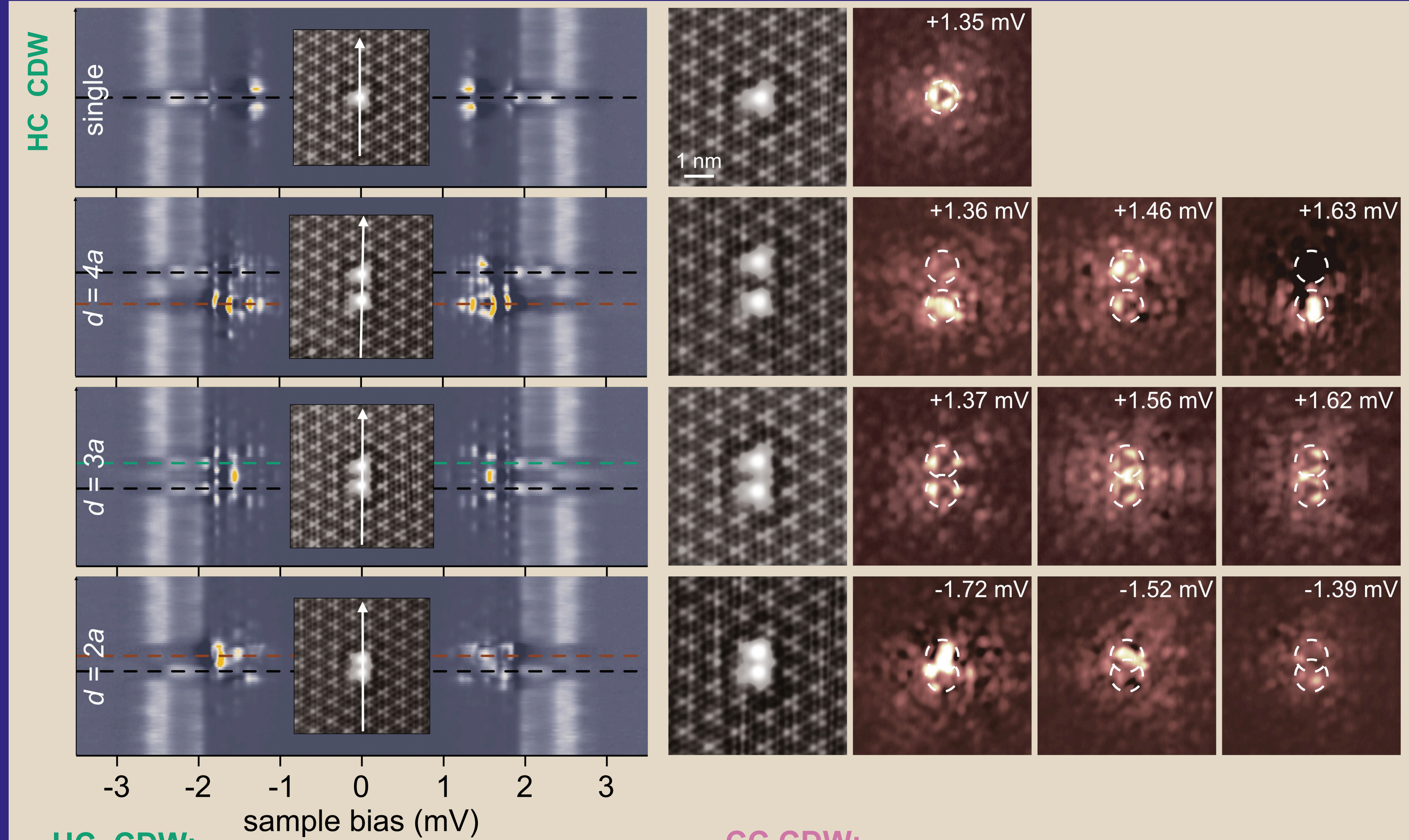
Fe dimers on NbSe₂



More peaks on dimer atoms → splitting?

Spectra of both atoms only similar for 3a Spectra of both atoms similar (all spacings)

Symmetry of dimer YSR states



HC CDW:

- Hybridization only for 3a
- More peaks observed in spectra due to overlap of YSR states of neighboring atoms

CC CDW:

- Hybridization for all spacings
- Perfect symmetry only for 3a

3a spacing most promising