

# FEMTOSECOND-LASER INDUCED DYNAMICS OF CO ON Ru(0001): NEW INSIGHTS FROM A HOT-ELECTRON, ELECTRONIC FRICTION MODEL INCLUDING SURFACE MOTION

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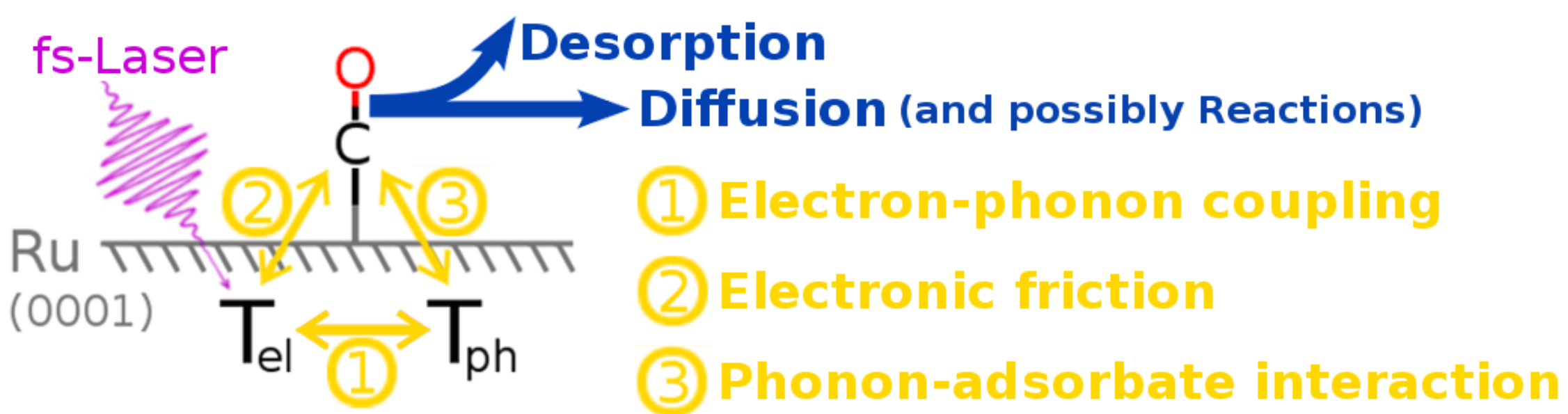
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## Introduction

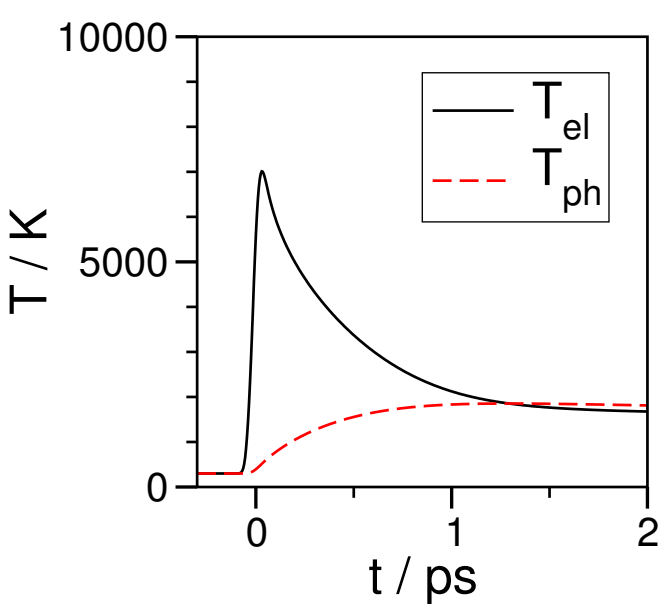
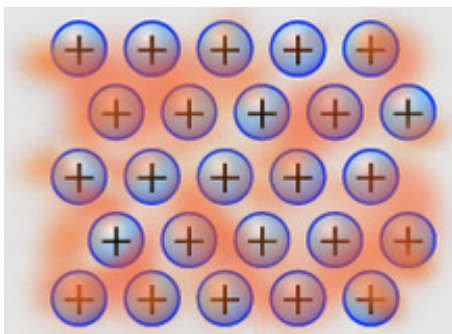
### Motivation

- research on small molecules adsorbed to metals is important for:
  - catalytic applications
  - fundamental understanding of bonding
- femtosecond(fs)-lasers are a valuable tool for such research as they
  - allow for investigations on small timescales
  - open up new processes compared to heating (femtophotochemistry)
  - may enable specific control over catalytic reactions (photocatalysis)

### How does fs-laser-irradiation affect metal surfaces?



- metals: ion lattice plus quasi-free electron gas
- visible light is absorbed only by the electrons
- electrons transfer part of energy to ion lattice, via ① **electron-phonon coupling** (phonons = lattice vibrations)
  - electrons couple to phonons as their fast movement causes “shockwaves” in ion lattice
  - equilibration process completes after  $\sim 1$  ps
- Thus, with fs-lasers, two temperatures emerge:



- $T_{el}$  - electron temperature
- $T_{ph}$  - phonon temperature
- time evolution can be simulated with a Two-Temperature Model [1]

## Models and Methods

## References

[1] S. I. Anisimov, B. L. Kapeliovich, and T. L. Perel'man, *Sov. Phys.-JETP* **39**, 375 (1974).

[2] M. Dell'Angela, T. Anniyev, M. Beye et al., *Science* **339**, 1302 (2013).