Dynamics and geometrical phase

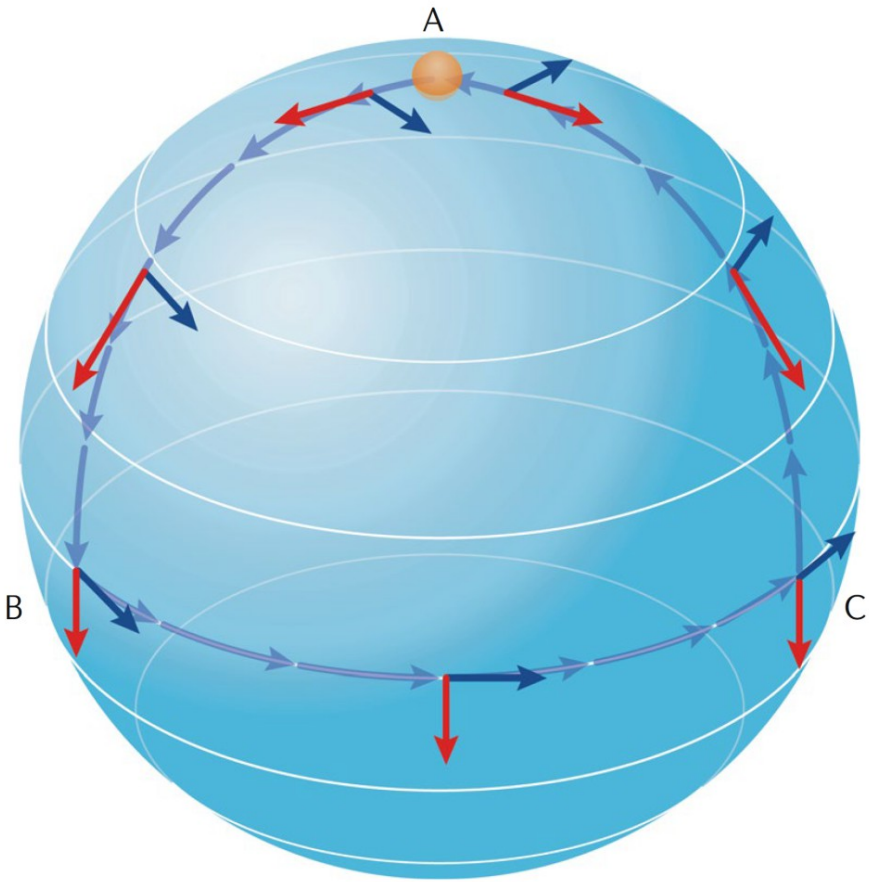
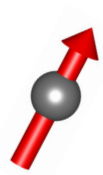


Image from Nature Rev. Phys. 1, 437 (2019)



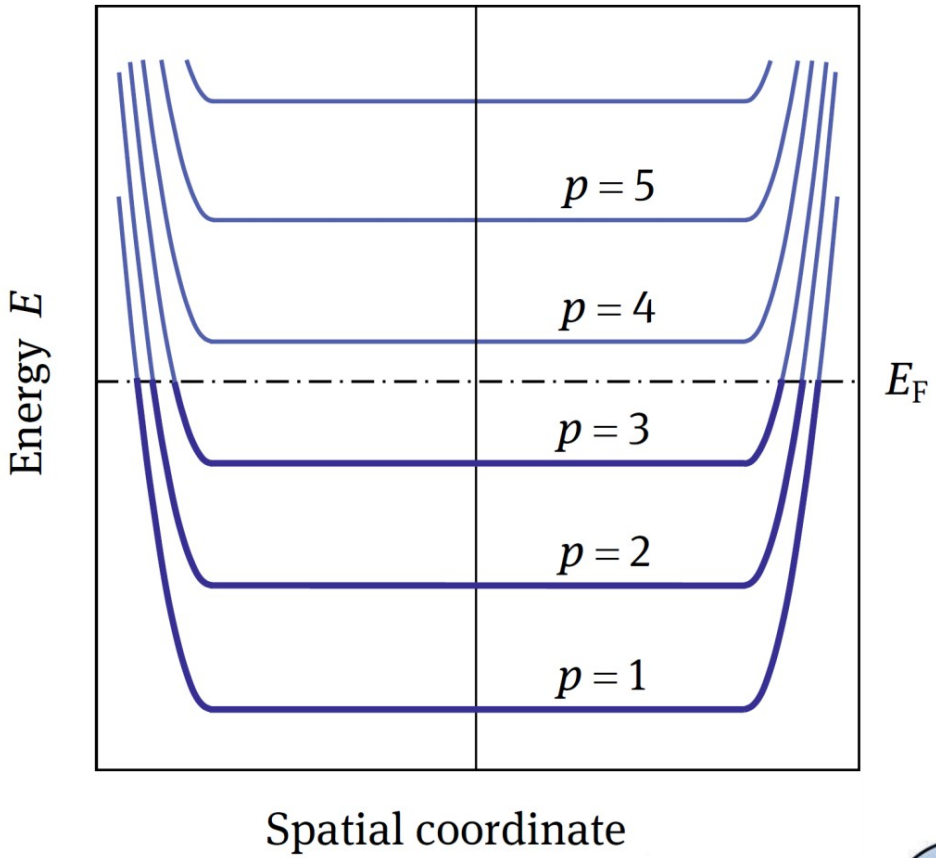
Berry curvature

Berry phase

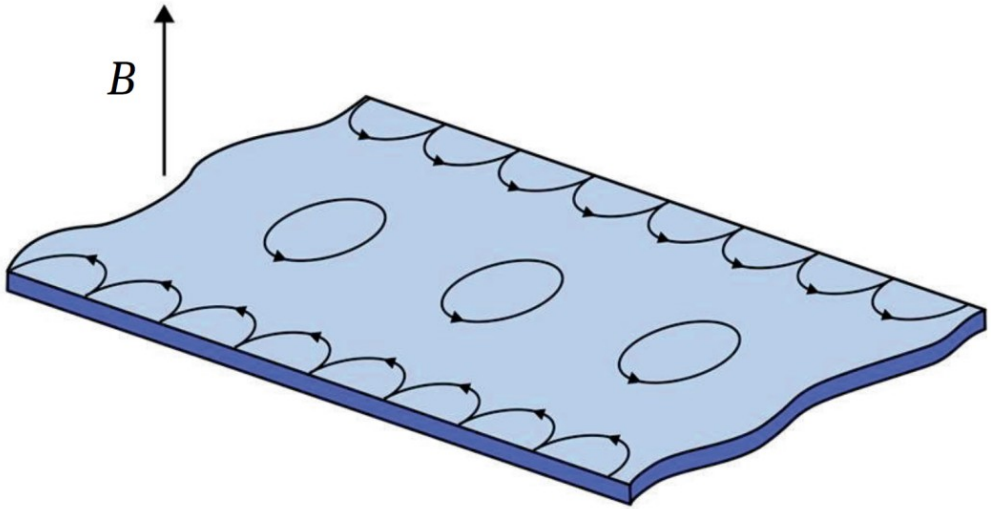


by Alexander Tsirlin, Leipzig University

Lecture 5: October 26, 2026



These modes are **chiral**
(propagate in one direction only)



One chiral mode
for each Landau level

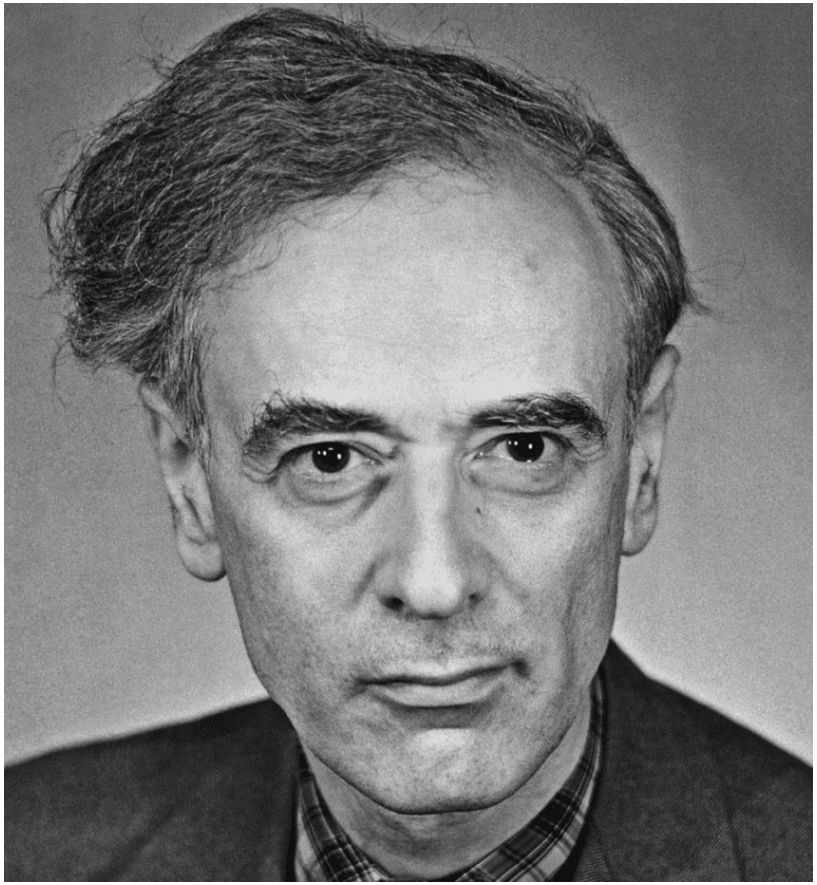
S. Hunklinger, Festkörperphysik

Landauer vs. Landau



Rolf Landauer

1927–1999



Lev Landau

1908–1968

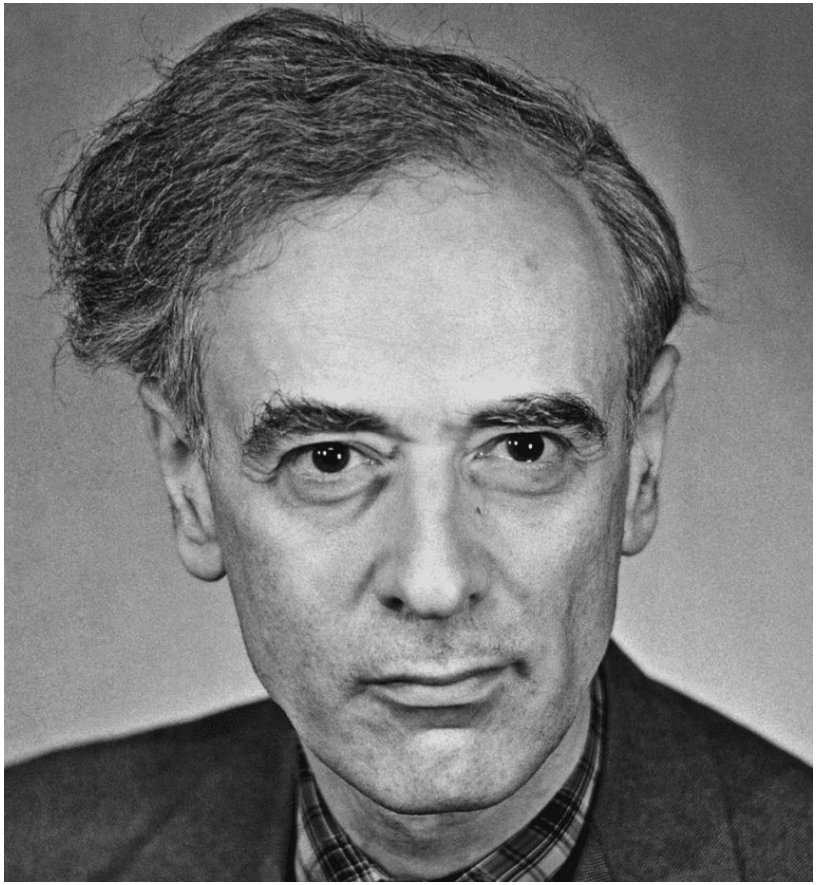
Landauer vs. Landau



Rolf Landauer

1927–1999

chiral modes (edge)

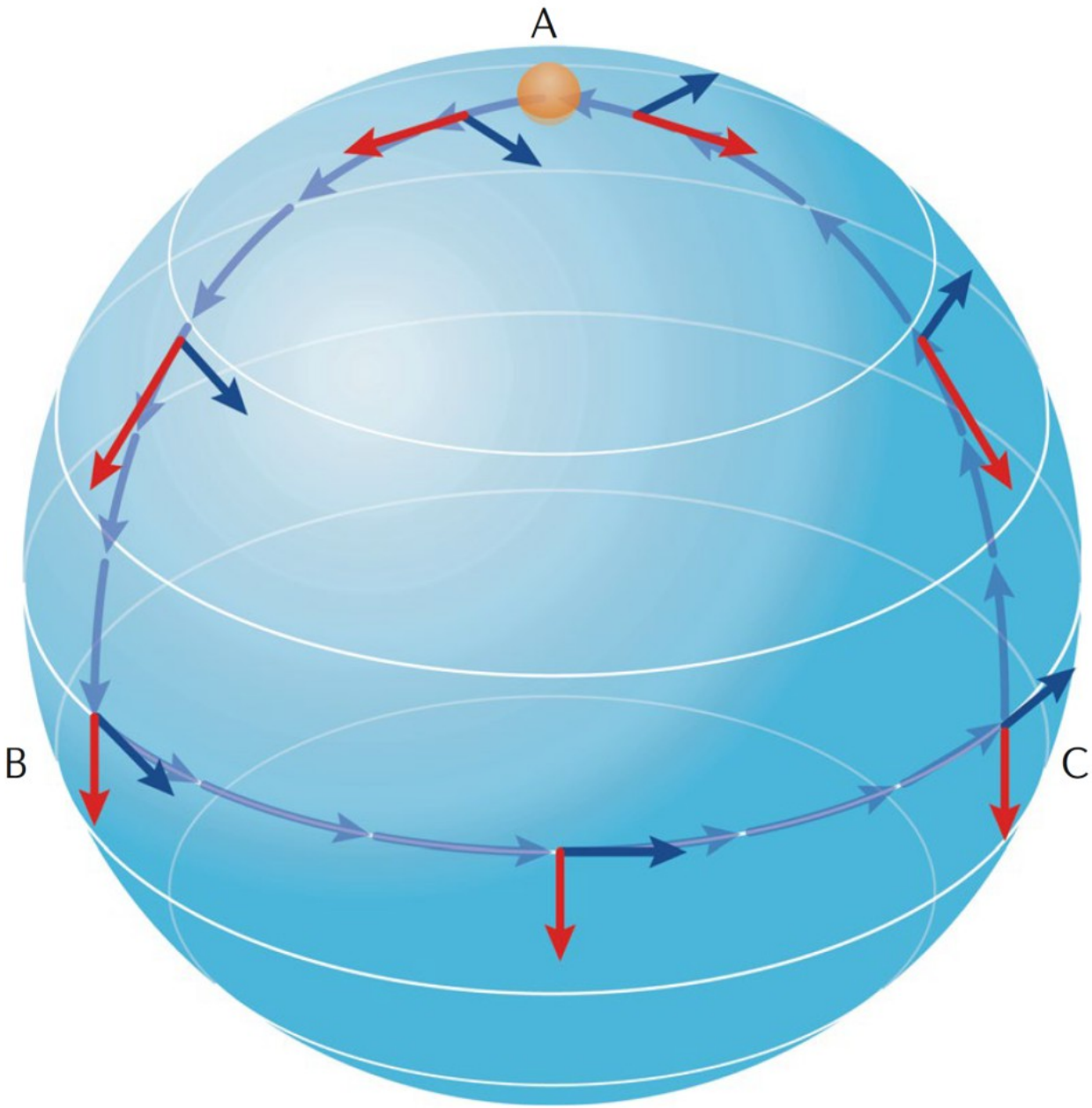


Lev Landau

1908–1968

Landau levels (bulk)

Parallel transport



Nature Rev. Phys. 1, 437 (2019)

Foucault pendulum



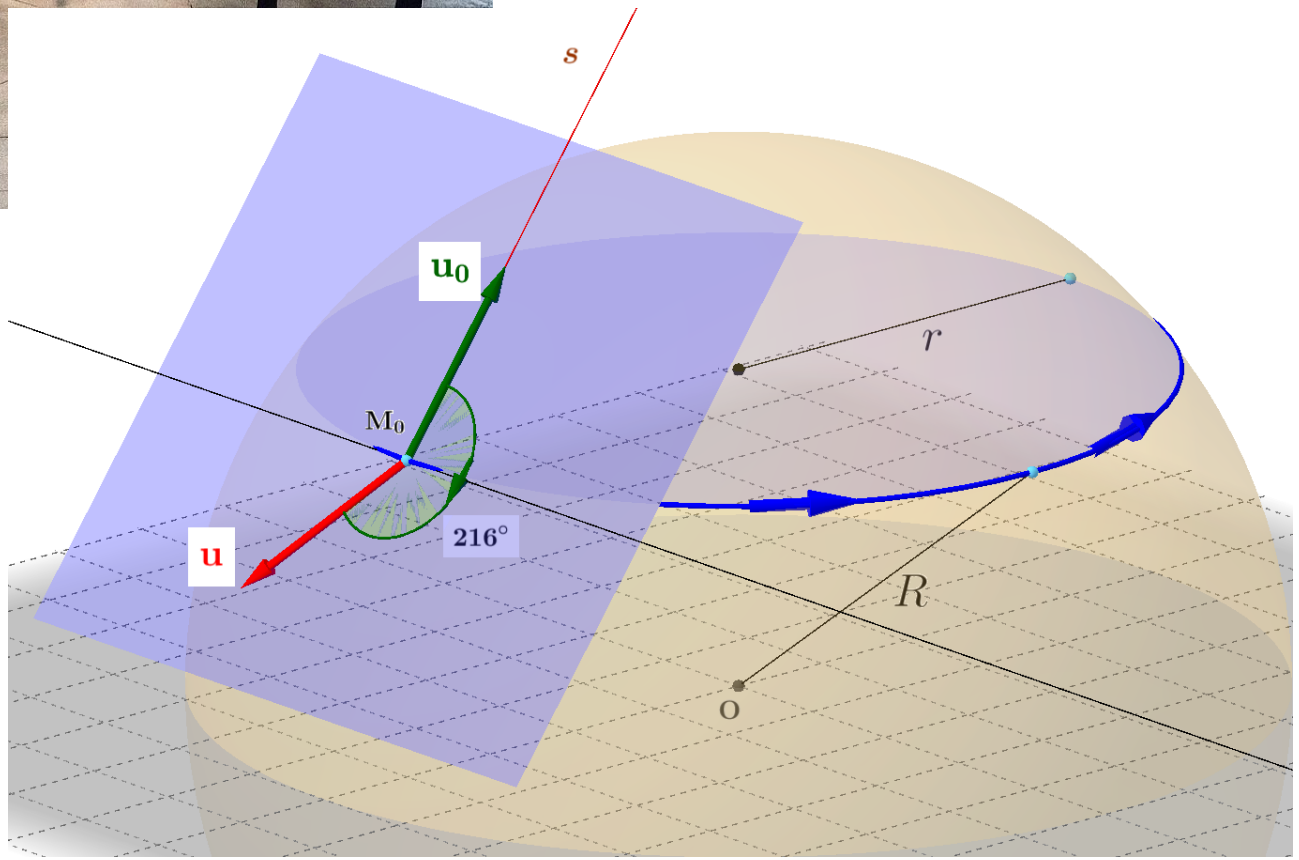
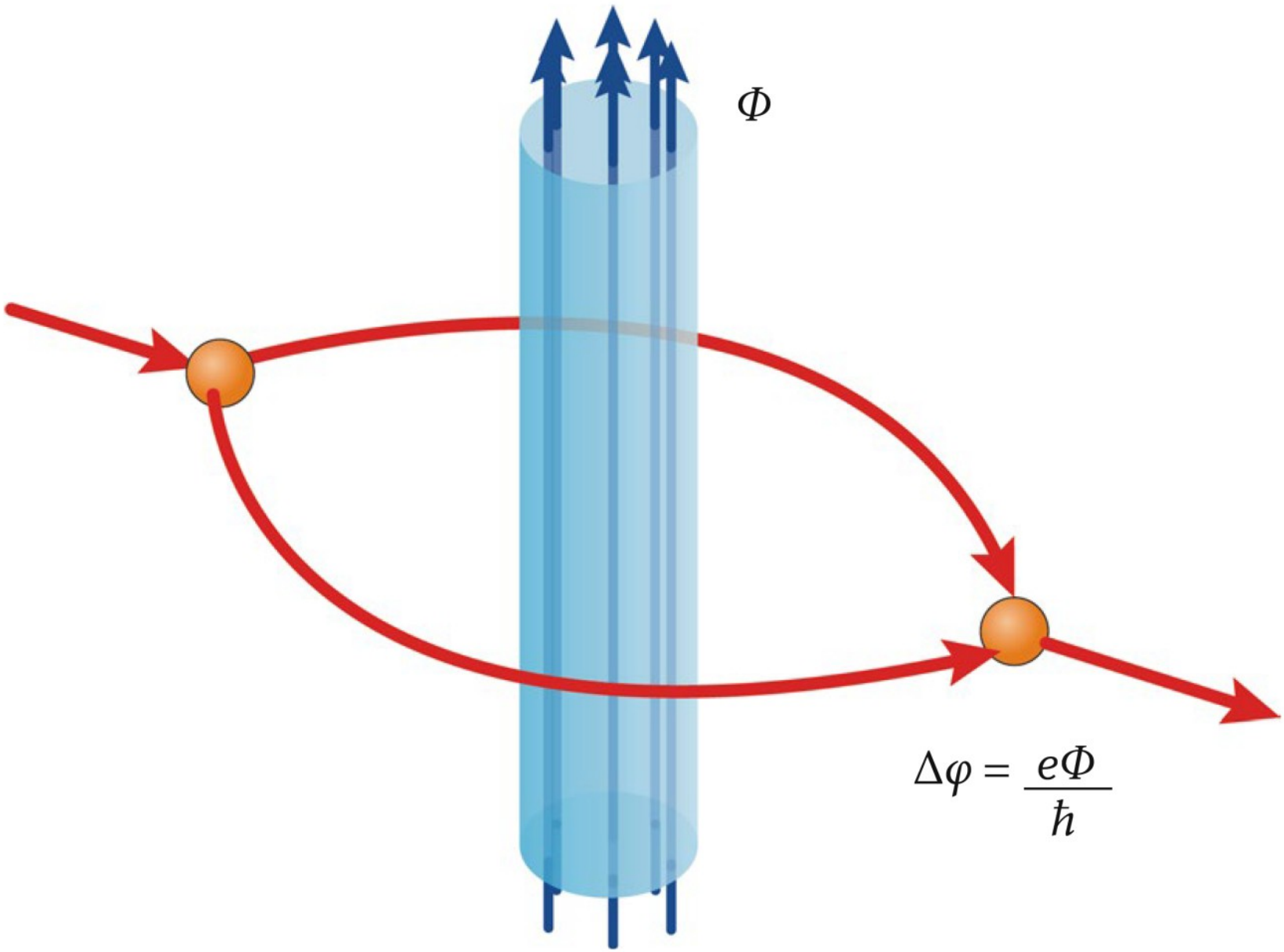


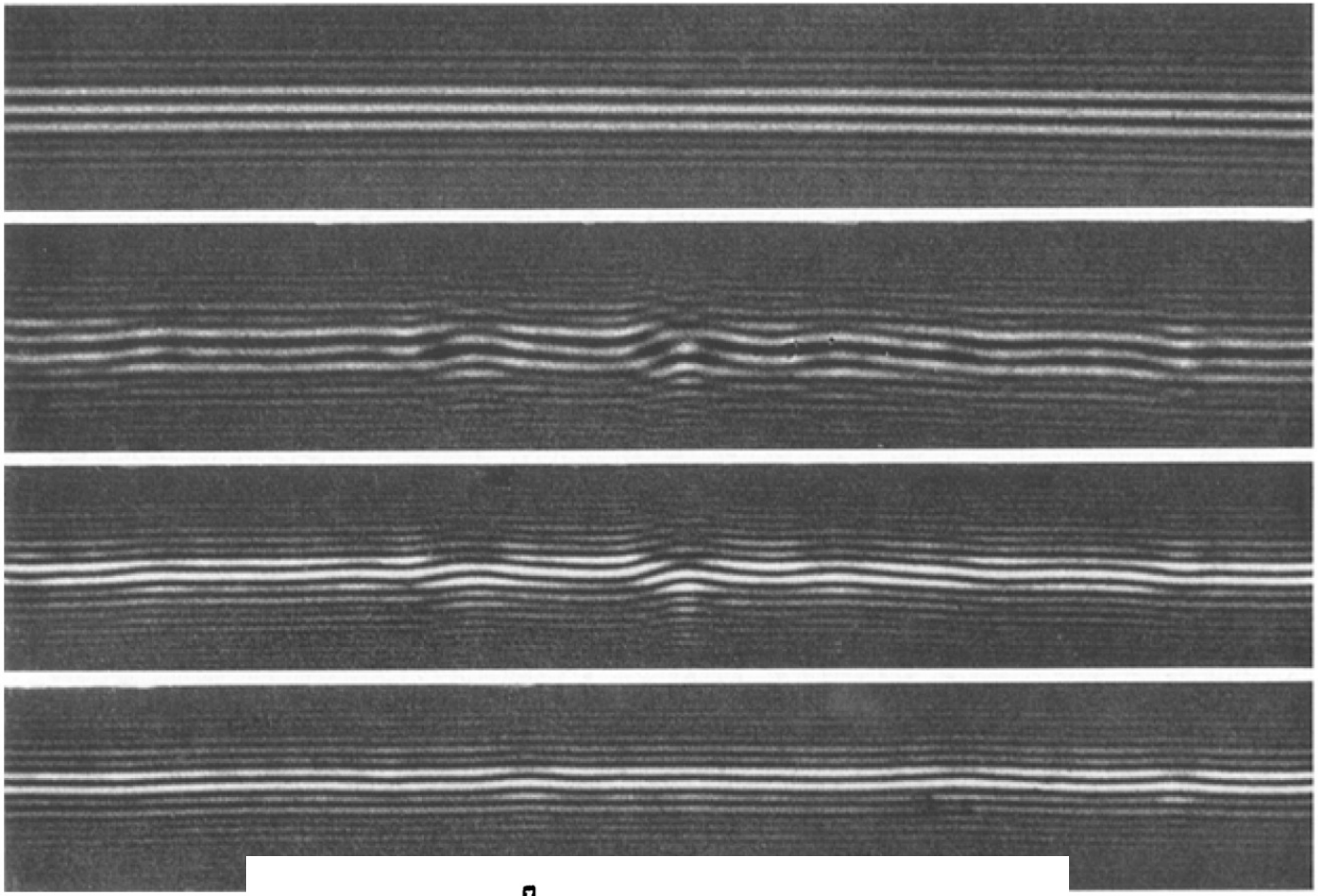
Image credits:
Franco Laeri and VoulKons (fair use)

Aharonov-Bohm effect



Nature Rev. Phys. 1, 437 (2019)

Aharonov-Bohm effect: electronic



field off

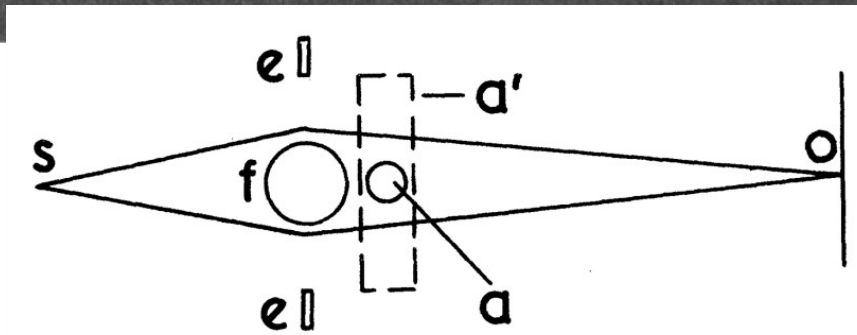
field on



field on

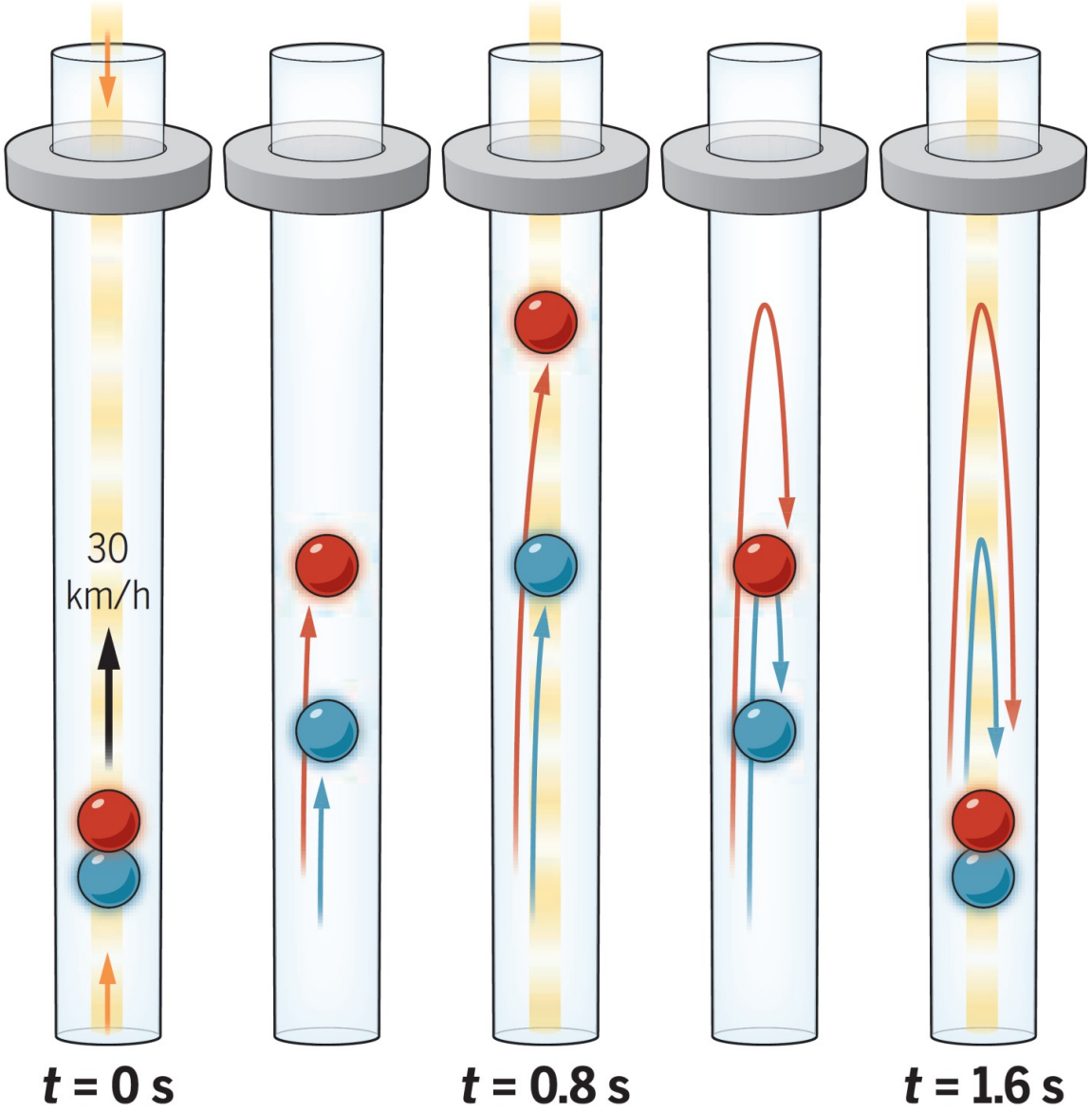


field off



Phys. Rev. Lett. 5, 3 (1960)
Z. Phys. 169, 263 (1962)

Aharonov-Bohm effect: also gravitational

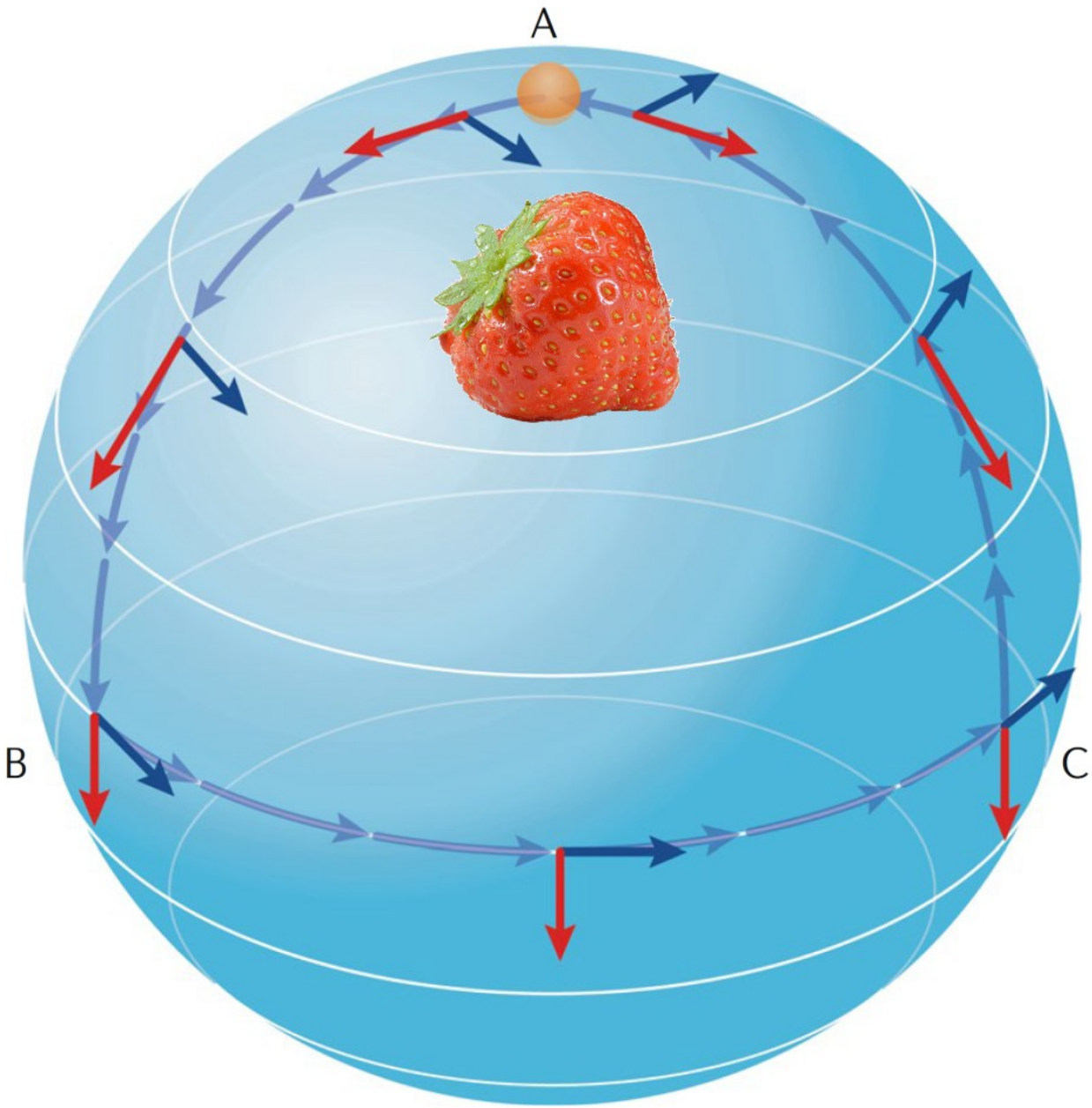


tungsten ring

Rb atoms

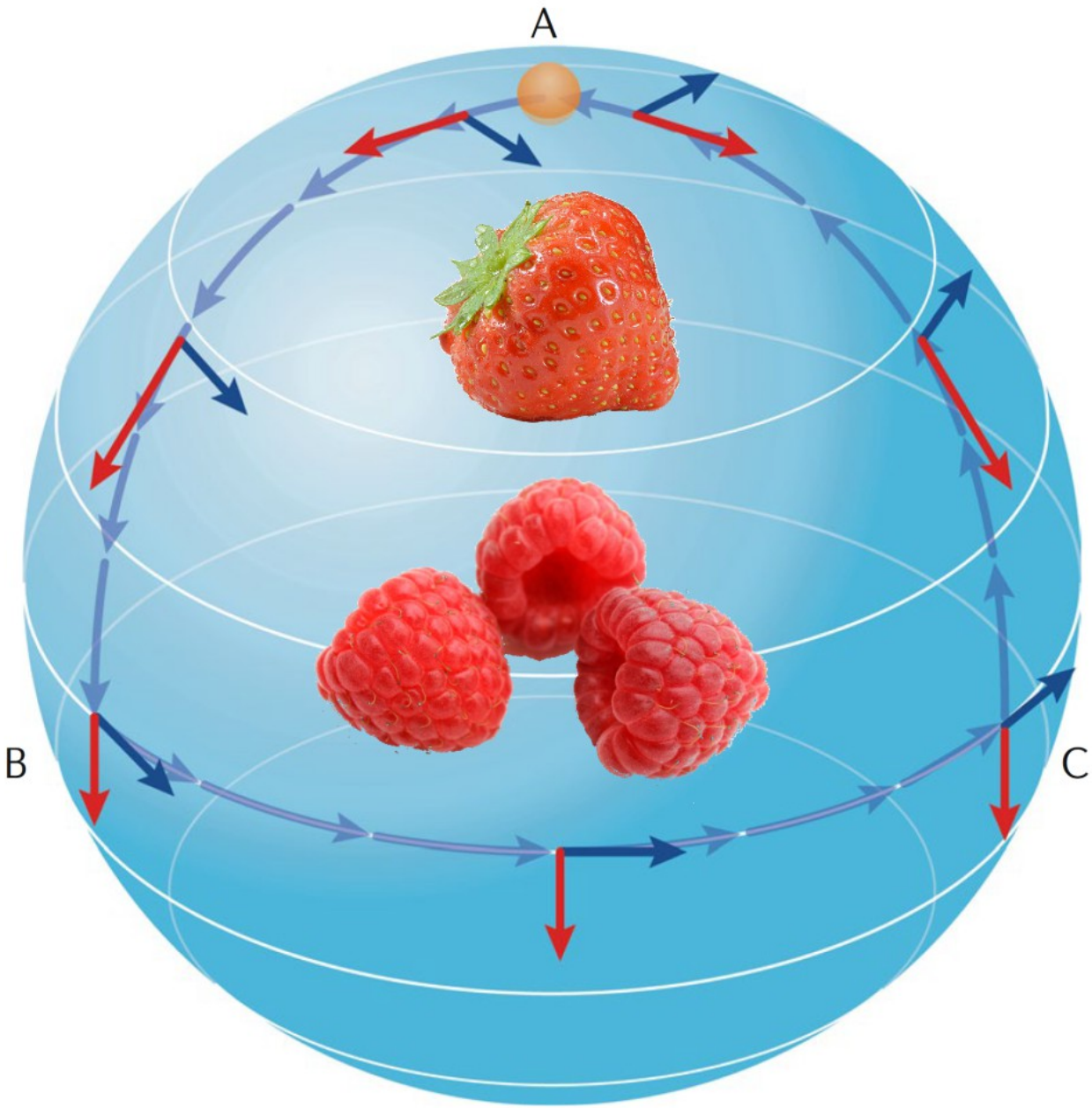
Science 375, 142 (2022)

Which Berry?



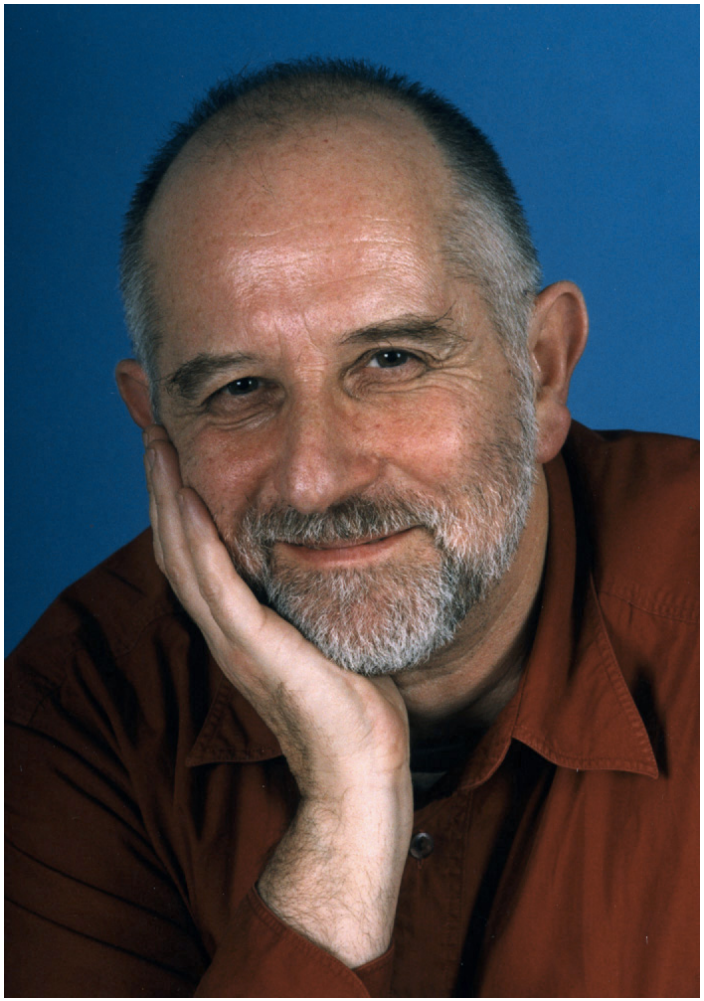
Nature Rev. Phys. 1, 437 (2019)
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Which Berry?



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Berry's face

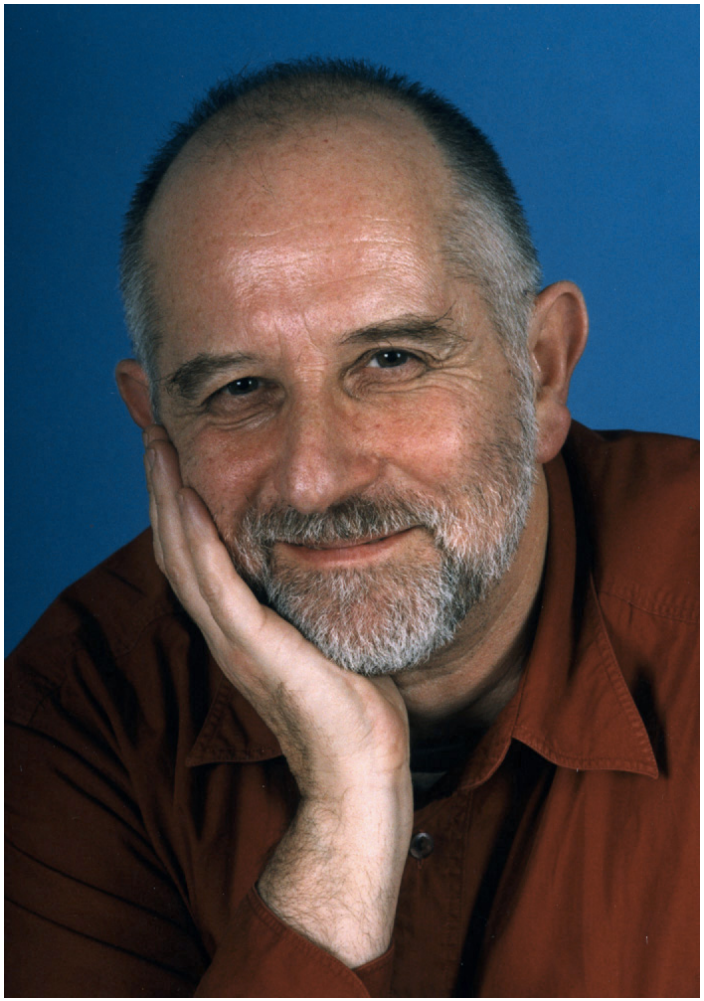


Sir Michael Berry
born 1941

1983: formulation of geometrical phase

2000: Ig Nobel prize (levitating frog)

Image credit: Michael Berry



Sir Michael Berry
born 1941

1983: formulation of geometrical phase

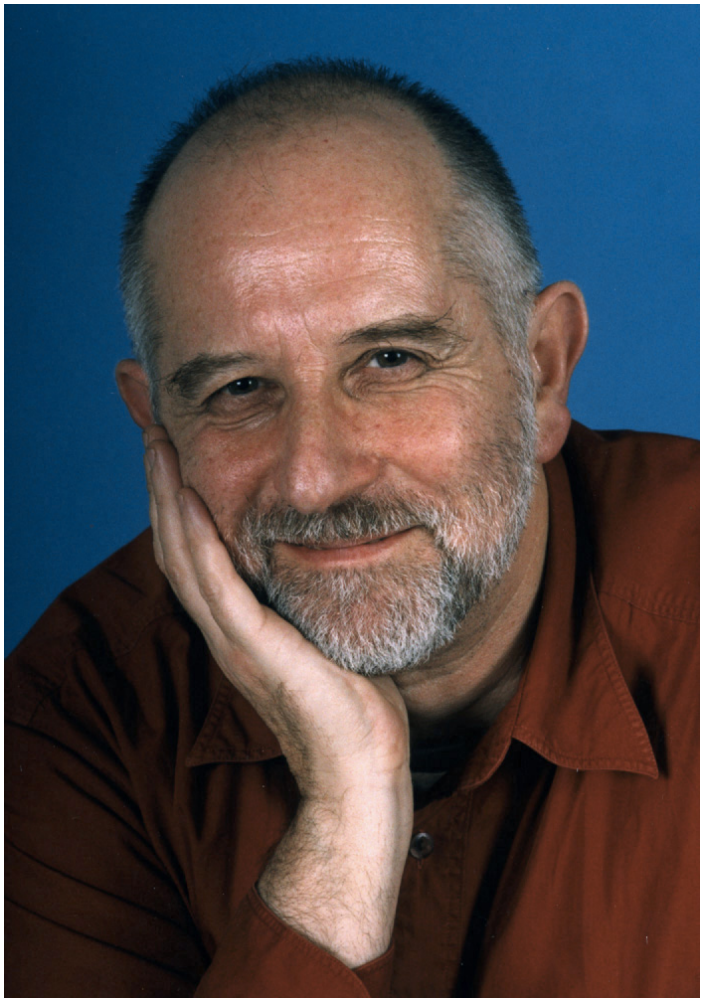
2000: Ig Nobel prize (levitating frog)

Related works

Pancharatnam (1956): geometrical phase in optics

Joshua Zak (1989): Berry phase in periodic systems

Image credit: Michael Berry



Sir Michael Berry
born 1941

1983: formulation of geometrical phase

2000: Ig Nobel prize (levitating frog)

Related works

Pancharatnam (1956): geometrical phase in optics

Joshua Zak (1989): Berry phase in periodic systems

"Nothing is ever discovered for the first time" (Michael Berry)

Image credit: Michael Berry