

Wen-Te Liao
Department of Physics



國立中央大學
National Central University



Physics Dep.

Who I am

Wen-Te Liao (廖文德)

wente.liao@g.ncu.edu.tw

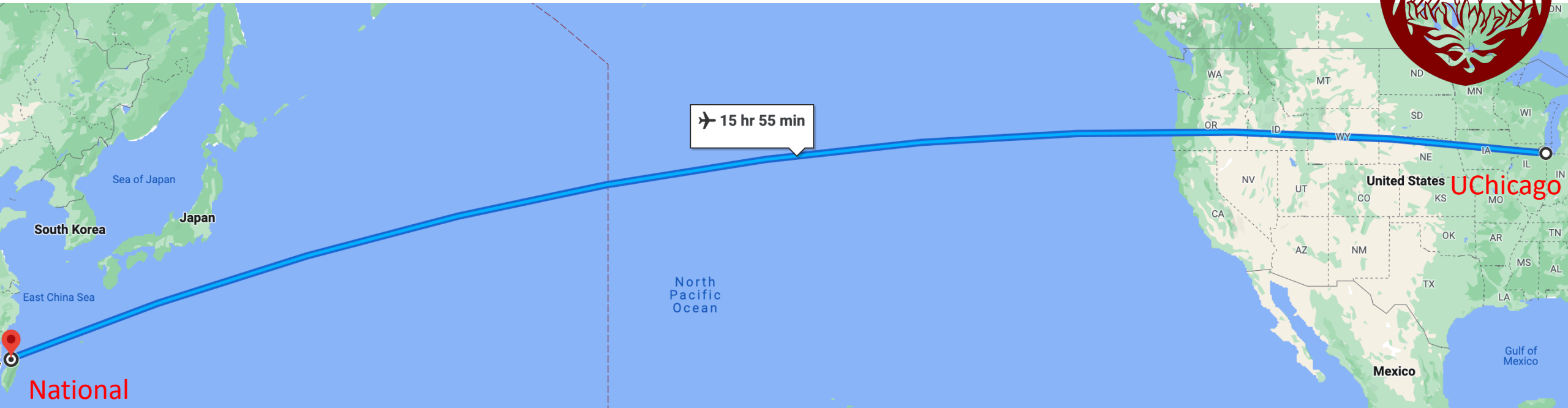
<https://wenteliao.wixsite.com/wente-liao-ncu>

PhD from Heidelberg University & MPI for Nuclear Physics, Germany
Department of Physics, National Central University

Theoretical quantum optics & X-ray quantum optics



Where we are

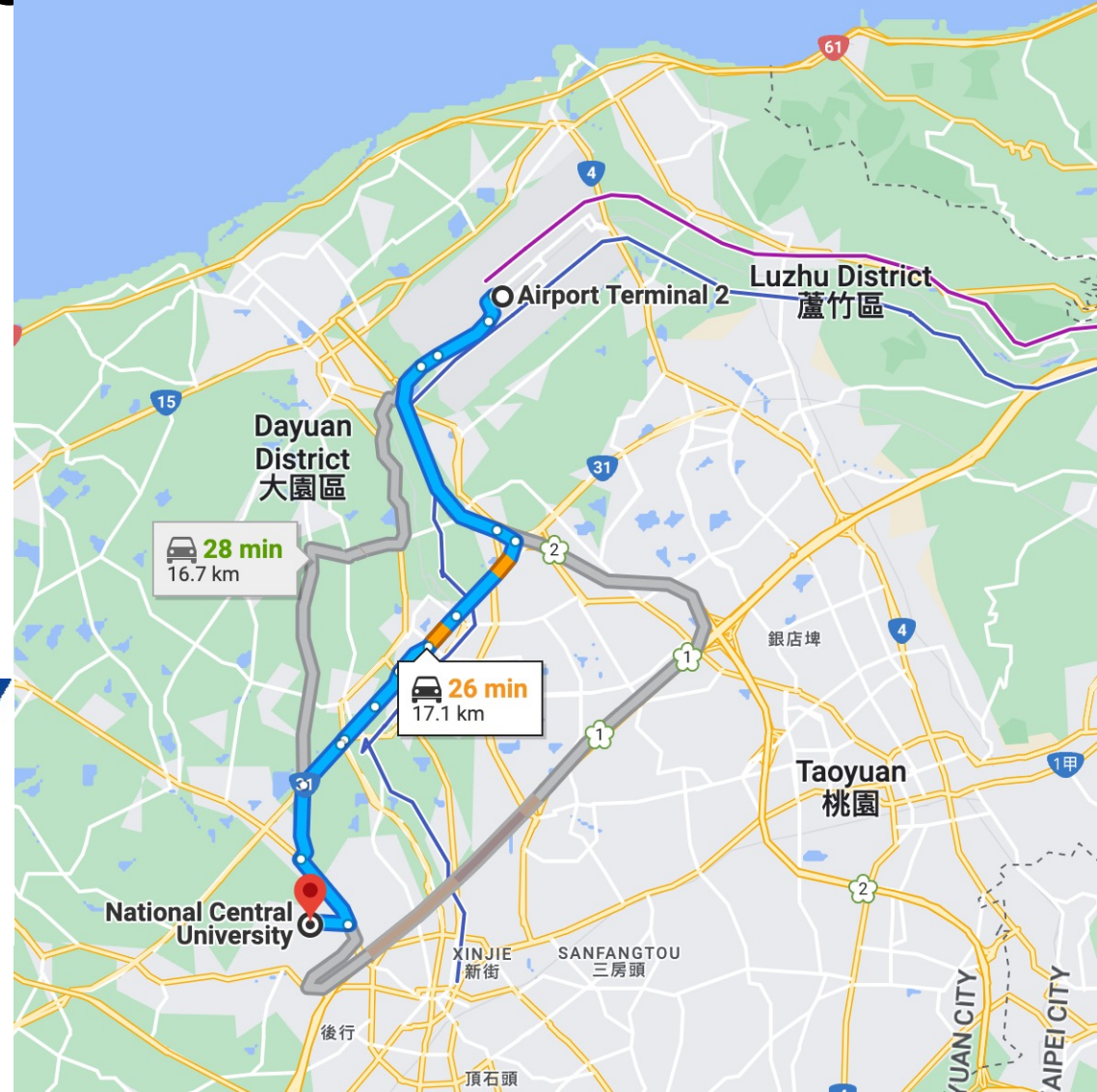
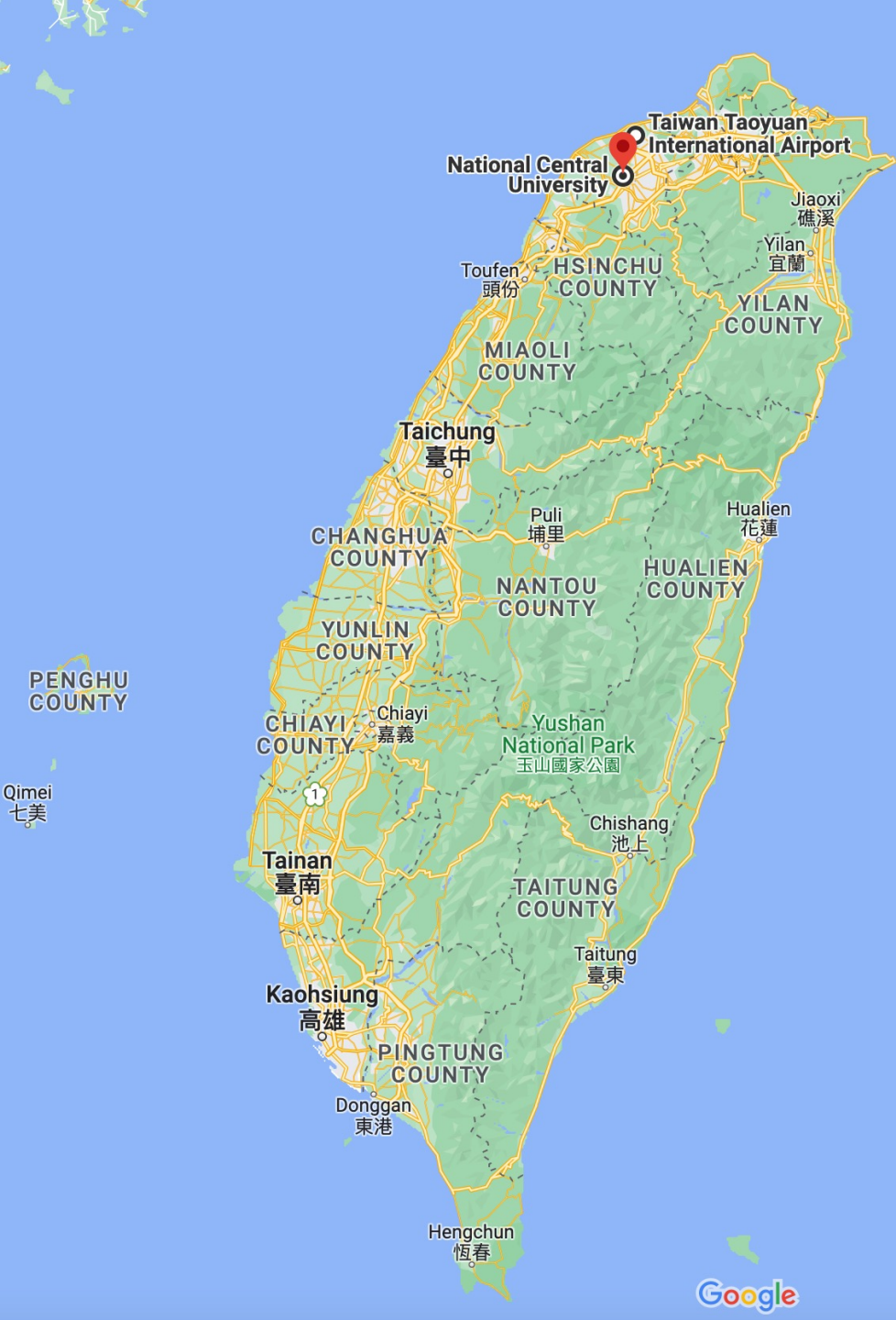


National
Central
University



National Central University(NCU)

In the North & 30min to Airport





Physics Dep.



NCU



國立中央大學

National Central University

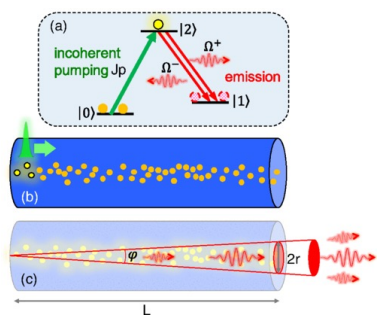


Physics Dep.

X-ray quantum optics

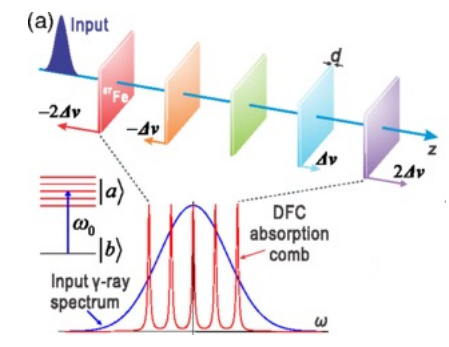
Transition between ASE and SF in a longitudinally pumped medium by XFEL

Y.-H. Kuan and WTL,
Phys. Rev. A 101, 023836 (2020)



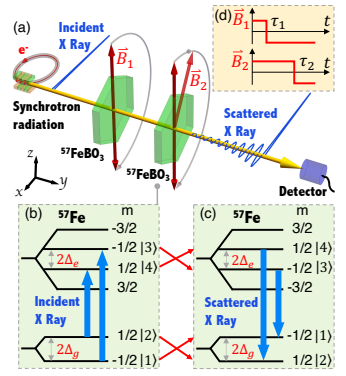
γ-ray quantum memory

X. Zhang, WTL, A. Kalachev,
R. Shakhmuratov, M. Scully, and
O. Kocharovskaya
Phys. Rev. Lett. **123**, 250504
(2019)



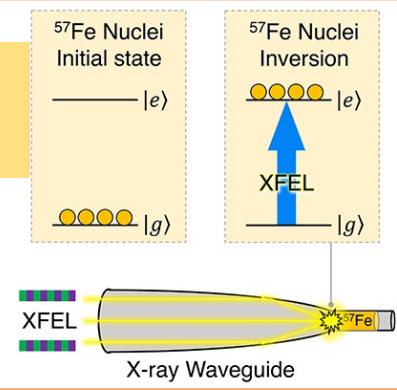
Magnetic Fano x-ray spectral enhancement

P.-H. Lin, Y.-H. Kuan, Y.-Y. Fu, and WTL,
Phys. Rev. Applied 18, L051001 (2022).



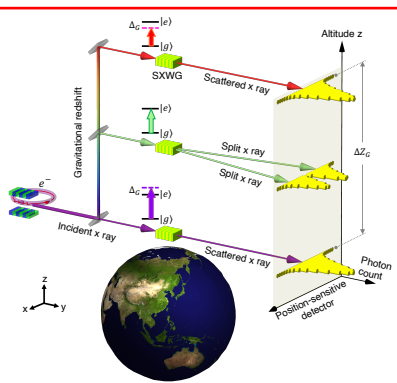
Transient nuclear inversion by x-ray free electron laser in a tapered x-ray waveguide

Y.-H. Chen, P.-H. Lin, G.-Y. Wang,
A. Pálffy, WTL,
Phys. Rev. Research 4, L032007
(2022)



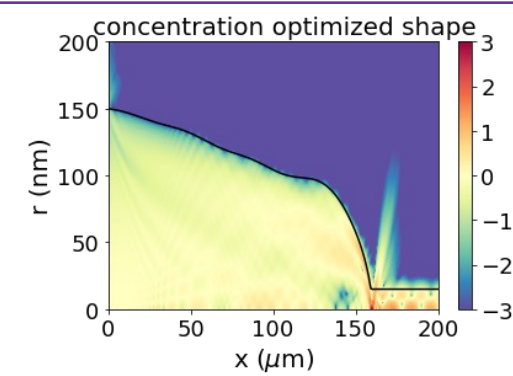
Gravitationally sensitive x-ray optics

S.-Y. Lee, S. Ahrens, and WTL,
to be submitted

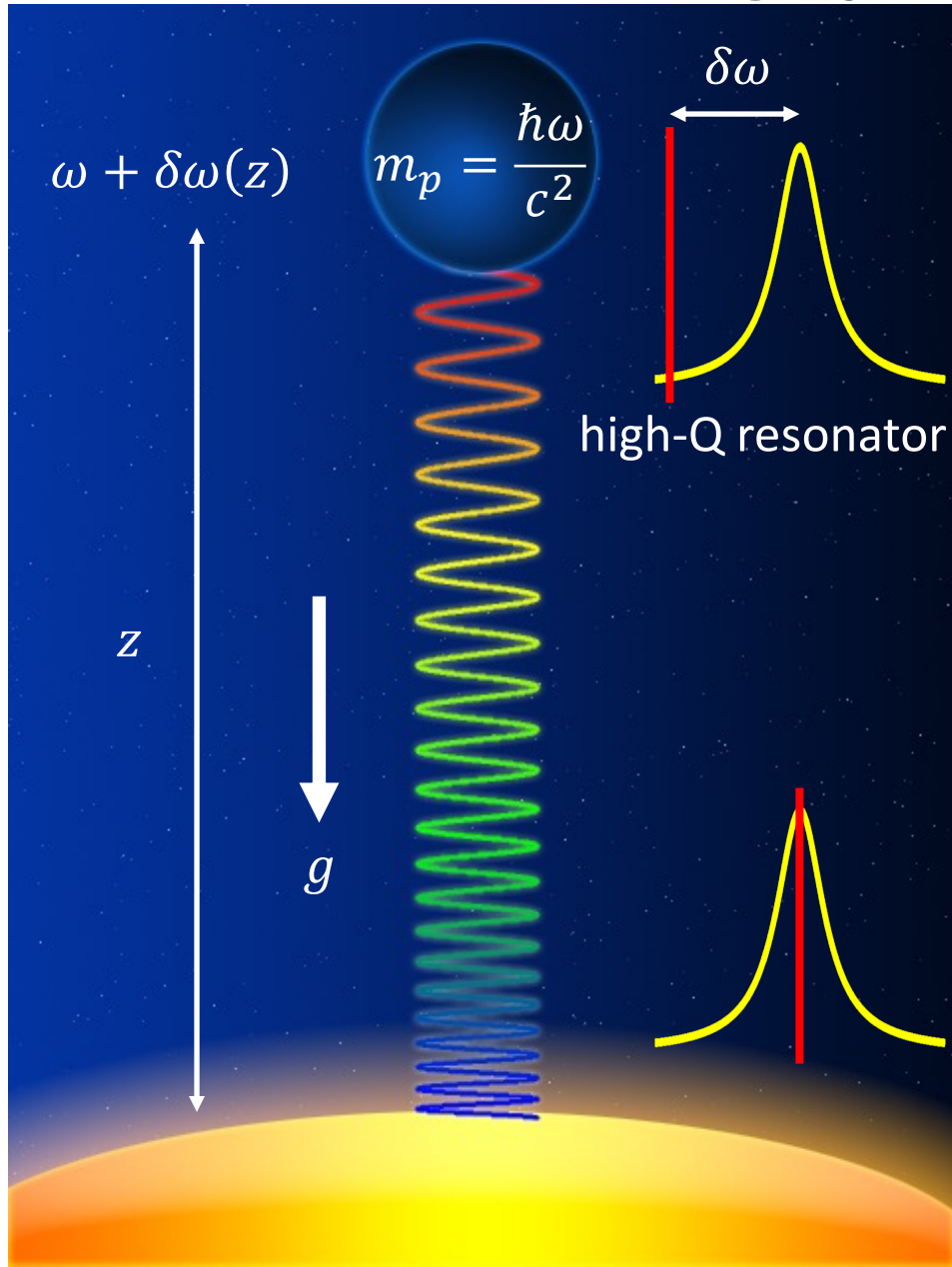


Optimization of x-ray waveguide geometry

S.-Y. Jian and WTL,
in preparation



Gravitational Redshift

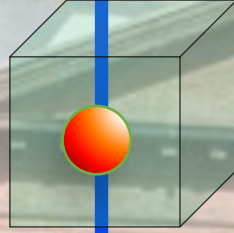


$$\hbar\delta\omega = \frac{\hbar\omega}{c^2} g z \rightarrow \frac{\delta\omega}{\omega} = \frac{g}{c^2} z$$

Pound- Rebka Experiment (1960)

22.5 m

^{57}Fe



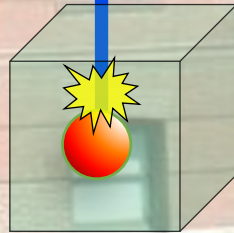
no absorption
due to Gravitational **RED** shift

γ -Ray

Earth's Gravity

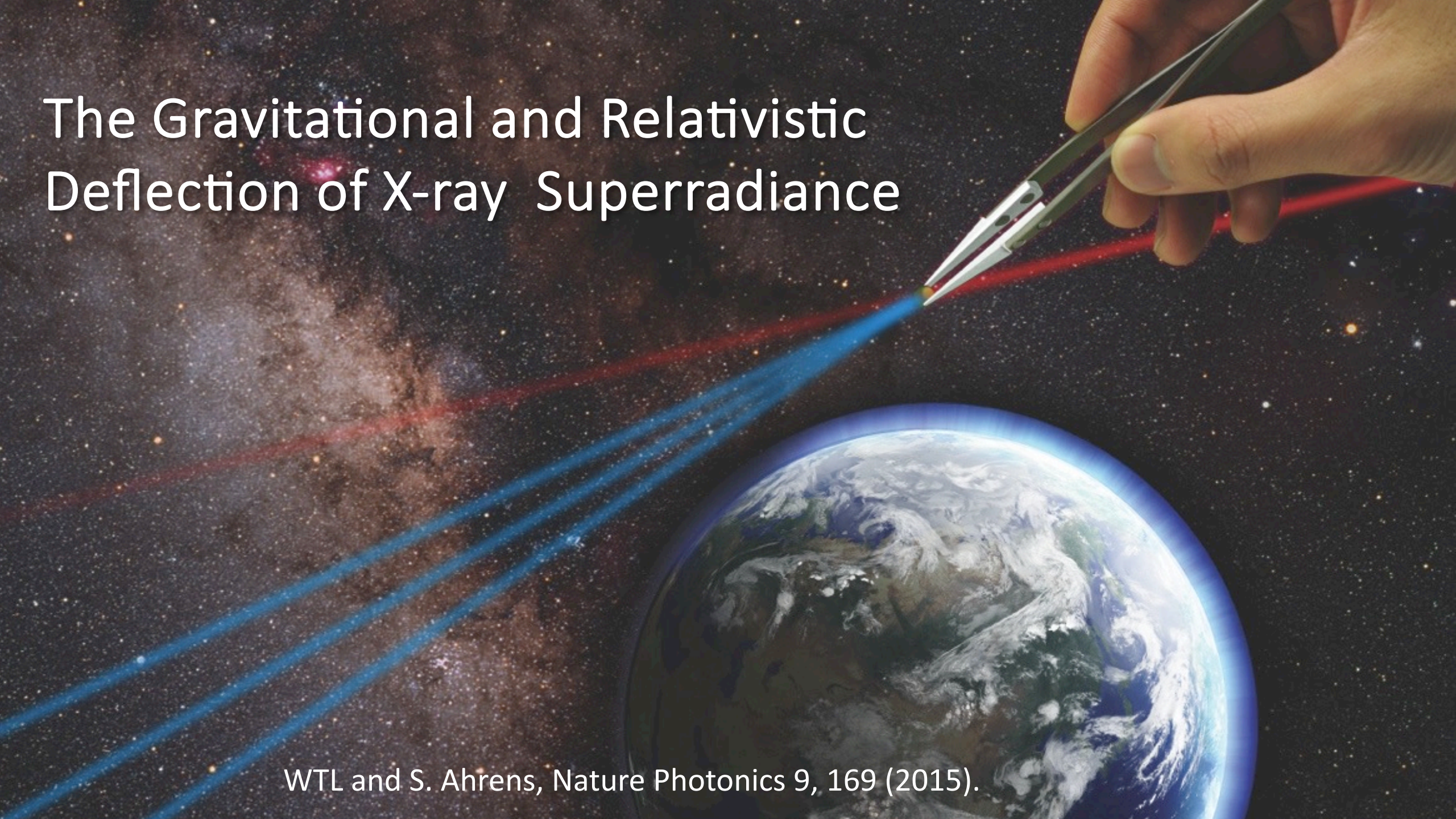


^{57}Co



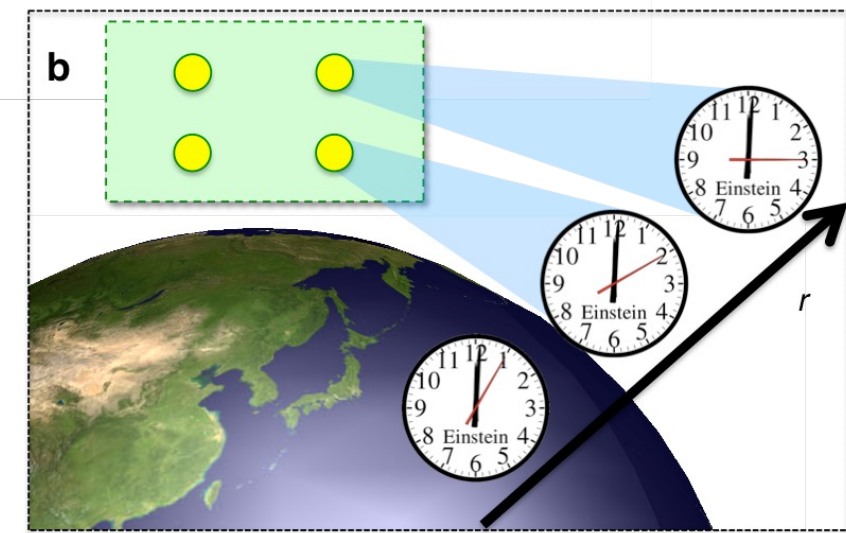
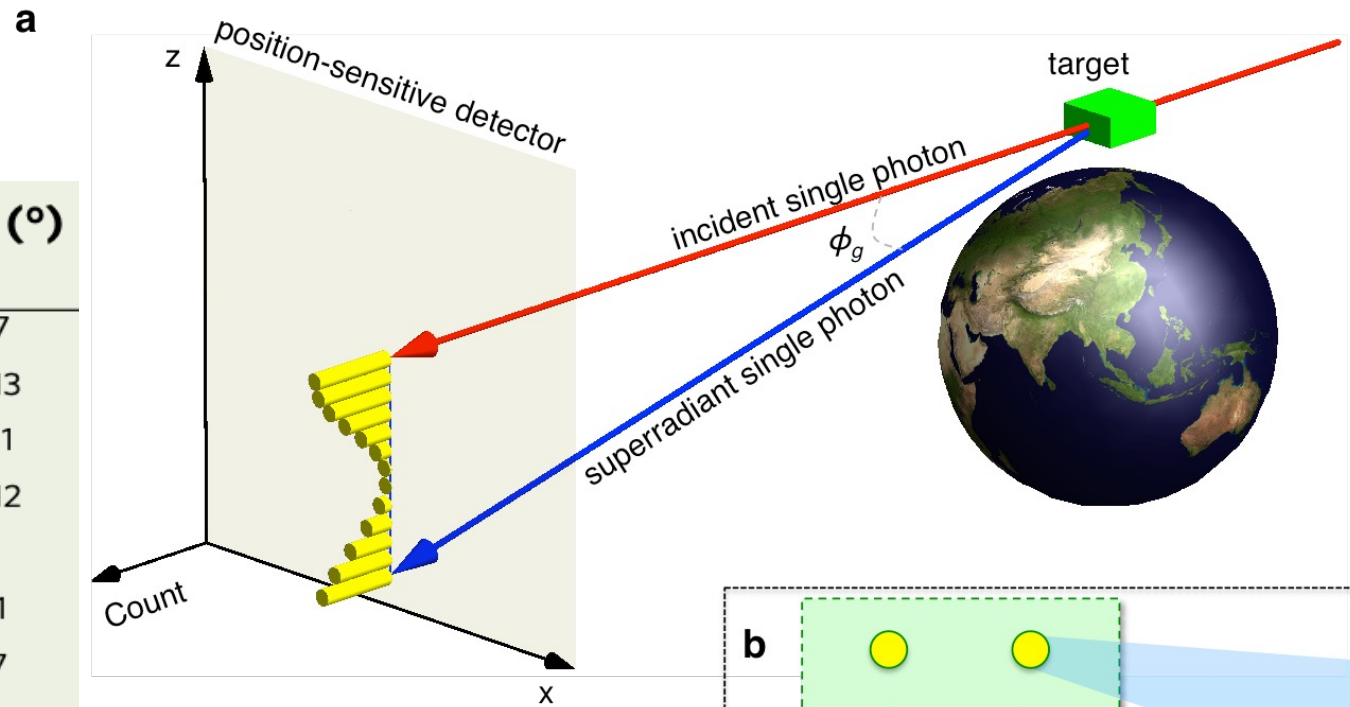
The Gravitational and Relativistic Deflection of X-ray Superradiance

WTL and S. Ahrens, *Nature Photonics* 9, 169 (2015).



Gravitational Deflection of Superradiance

Crystal	E_e (keV)	Coherence time τ_{coh}	$\phi_g(\tau_{\text{coh}})$ ($^\circ$)
^{45}Sc	12.4	459 ms	8.6×10^{-7}
^{57}Fe	14.41	141 ns	2.6×10^{-13}
^{67}Zn	93.31	13.09 μs	2.5×10^{-11}
^{73}Ge	13.28	4.21 μs	7.9×10^{-12}
^{109}Ag	88.03	57.13 s	1.1×10^{-4}
^{181}Ta	6.24	8.73 μs	1.6×10^{-11}
^{182}Ta	16.27	408 ms	7.7×10^{-7}
$^{229}\text{Th}:\text{CaF}_2$	0.0078	1 ms	1.9×10^{-9}





Gravitationally Sensitive Structured X-Ray Optics Using Nuclear Resonances

S.-Y. Lee, S. Ahrens, W.-T. Liao, arXiv: 2305.00613
(2023)

Altitude-dependent Rabi Frequency

