hacking aerosol-cloud µ-physics modeling concepts in python™

mini-workshop:
20th, 21st & 23rd Jan 2026
(12:30-3:30pm room ATG 406)

speakers:

- Sylwester Arabas @agh.edu.pl
- Emma Ware @ucdavis.edu

photo: Eugene Tmashov / National Geographic ("Cloud and ship", from Al-Peteri, Crimea, Ukraine) - https://tmashov.games/

tools:

NumPy

Numba

PySDM

```python
def sdm(*,
    rng: np.random.Generator,
    ξ: abc.MutableSequence[int],
    m: abc.MutableSequence[float],
    kern: abc.Callable[[float, float], float],
    Δt: float,
    Δv: float,
):
    """ SDM step assuming non-zero multiplicities """
    n_s = len(ξ)
    n_pair = n_s // 2
    pairs = rng.permutation(n_s)[: 2 * n_pair]
    ϕ = rng.uniform(0, 1, n_pair)
    p_ratio = n_s * (n_s - 1) / 2 / n_pair
    for α, (j, k) in enumerate(pairs.reshape(-1, 2)):
        p_jk = kern(m[j], m[k]) * Δt / Δv
        if ξ[j] < ξ[k]:
            j, k = k, j
        p_α = ξ[j] * p_ratio * p_jk
        γ = p_α // 1 + (p_α - p_α // 1) > ϕ[α]
        if γ != 0:
            γ = min(γ, (ξ[j] / ξ[k]) // 1)
            if ξ[j] - γ * ξ[k] > 0:
                ξ[j] -= γ * ξ[k]
                m[k] += γ * m[j]
            else:
                ξ[j] = ξ[k] // 2
                ξ[k] -= ξ[j]
                m[k] += γ * m[j]
                m[j] = m[k]
```

please bring your laptops/tablets, browser is the only requirement

tentative agenda:

- Tue, 20th Jan:
  - SDM Monte-Carlo sheme from scratch in Python
  - lightning talk on adaptive SDM (Ware et al. 2025, arXiv:2509.05536)
- Wed, 21st Jan:
  - CCN activation model from scratch in Python (unit handling with Pint)
- Fri, 23rd Jan:
  - PySDM cloud-modeling package tutorial
  - lightning talk on immersion freezing in SDM (Arabas et al. 2025, JAMES)

Erasmus+

AGH

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