Independent identification of meteor showers

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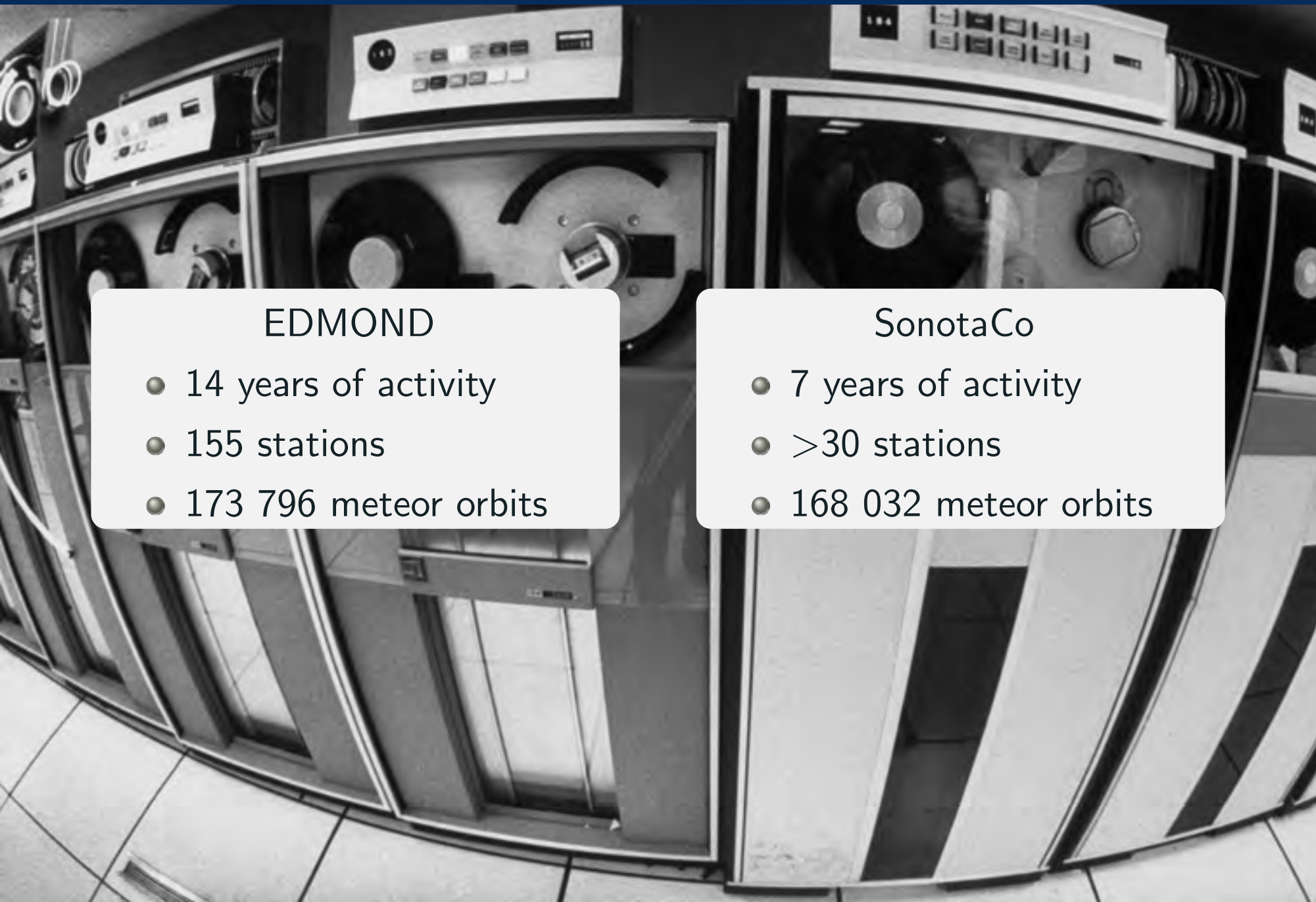
Scientific interest



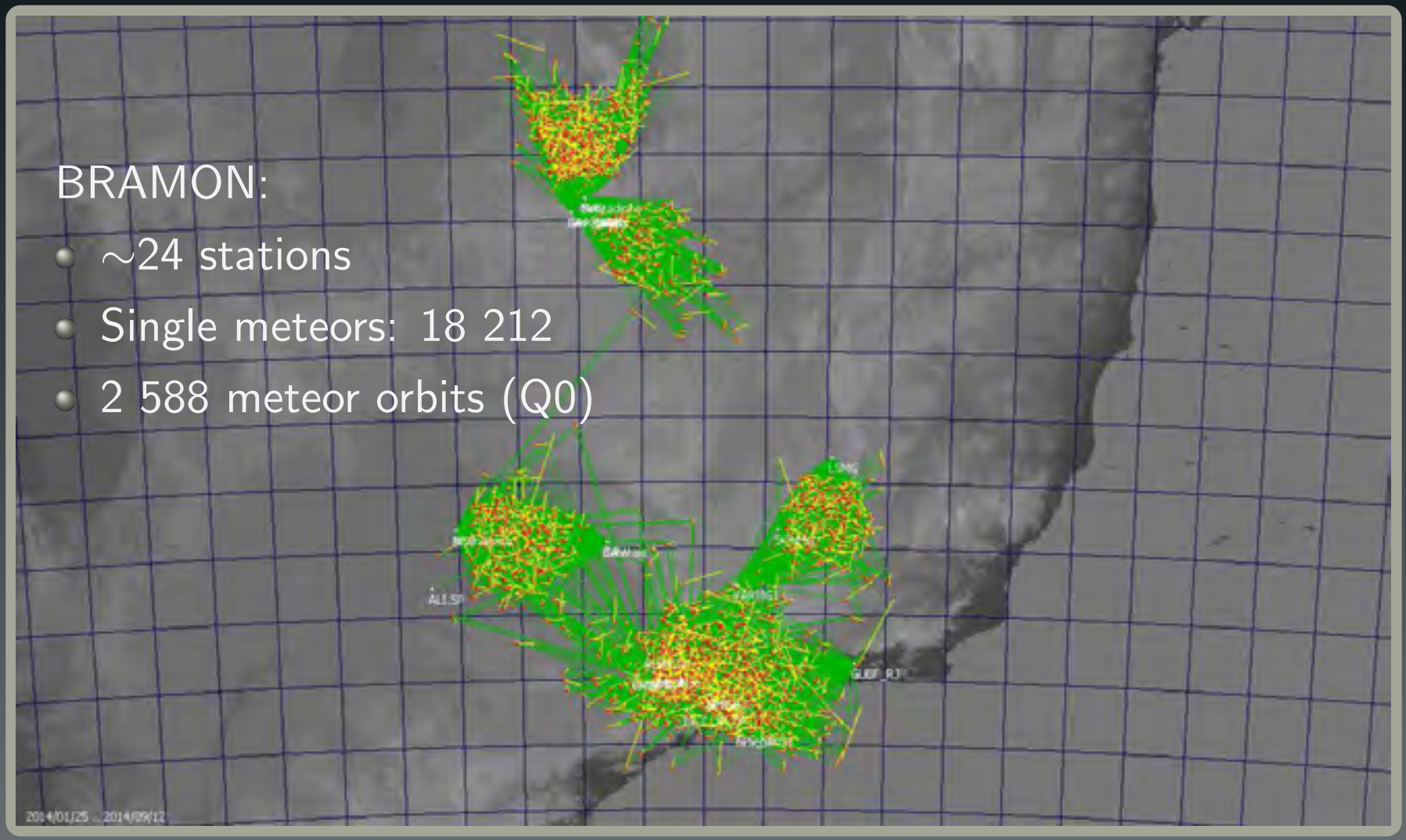
EDMOND

- 14 years of activity
- 155 stations
- 173 796 meteor orbits

SonotaCo

- 7 years of activity
- >30 stations
- 168 032 meteor orbits

Scientific interest

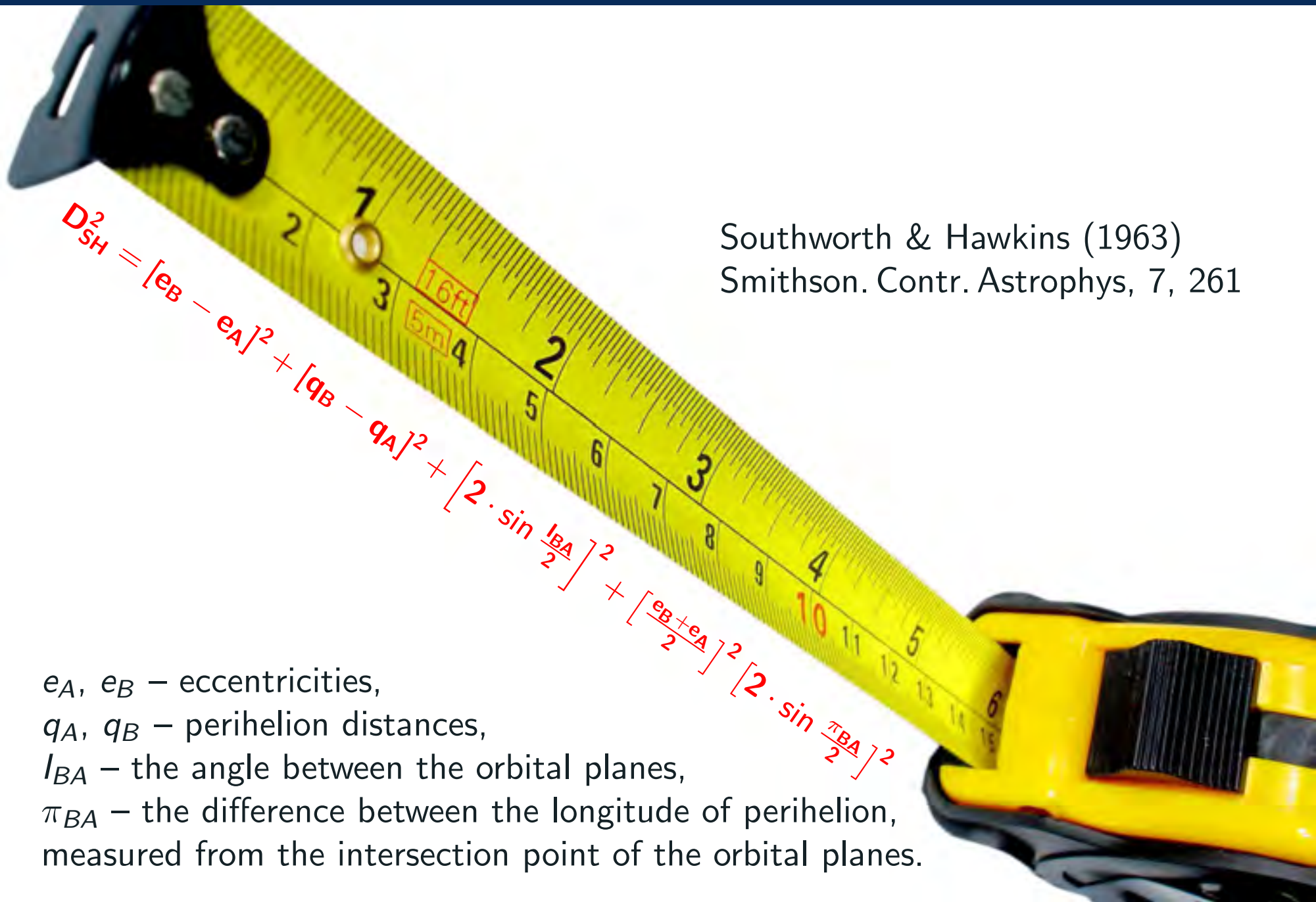


Thanks to Jakub Koukal and Roman Piffl (EDMOND consortium)

Meteoroid stream identification methods

- Choose a dynamical similarity function D-criterion.
- Choose a meteoroid streams search algorithm.
- Choose a similarity threshold D_c.

D-criterion



$$D_{SH}^2 = [e_B - e_A]^2 + [q_B - q_A]^2 + \left[2 \cdot \sin \frac{I_{BA}}{2}\right]^2 + \left[\frac{e_B + e_A}{2}\right]^2 \left[2 \cdot \sin \frac{\pi_{BA}}{2}\right]^2$$

Southworth & Hawkins (1963)
Smithson. Contr. Astrophys, 7, 261

e_A, e_B – eccentricities,
q_A, q_B – perihelion distances,
I_{BA} – the angle between the orbital planes,
π_{BA} – the difference between the longitude of perihelion, measured from the intersection point of the orbital planes.

Threshold

- "magic" 0.2
- $D_c = 0.2 \cdot \left(\frac{360}{N}\right)^{1/4}$

  Southworth, R.B. & Hawkins, G.S., (1963), Smithson. Contr. Astrophys, 7, 261
- $D_c = 0.8 \cdot N^{-1/4}$

  Lindblad, B.A., (1971), Smithson. Contr. Astrophys, 12, 14
- $P(K = 1, M = const)$

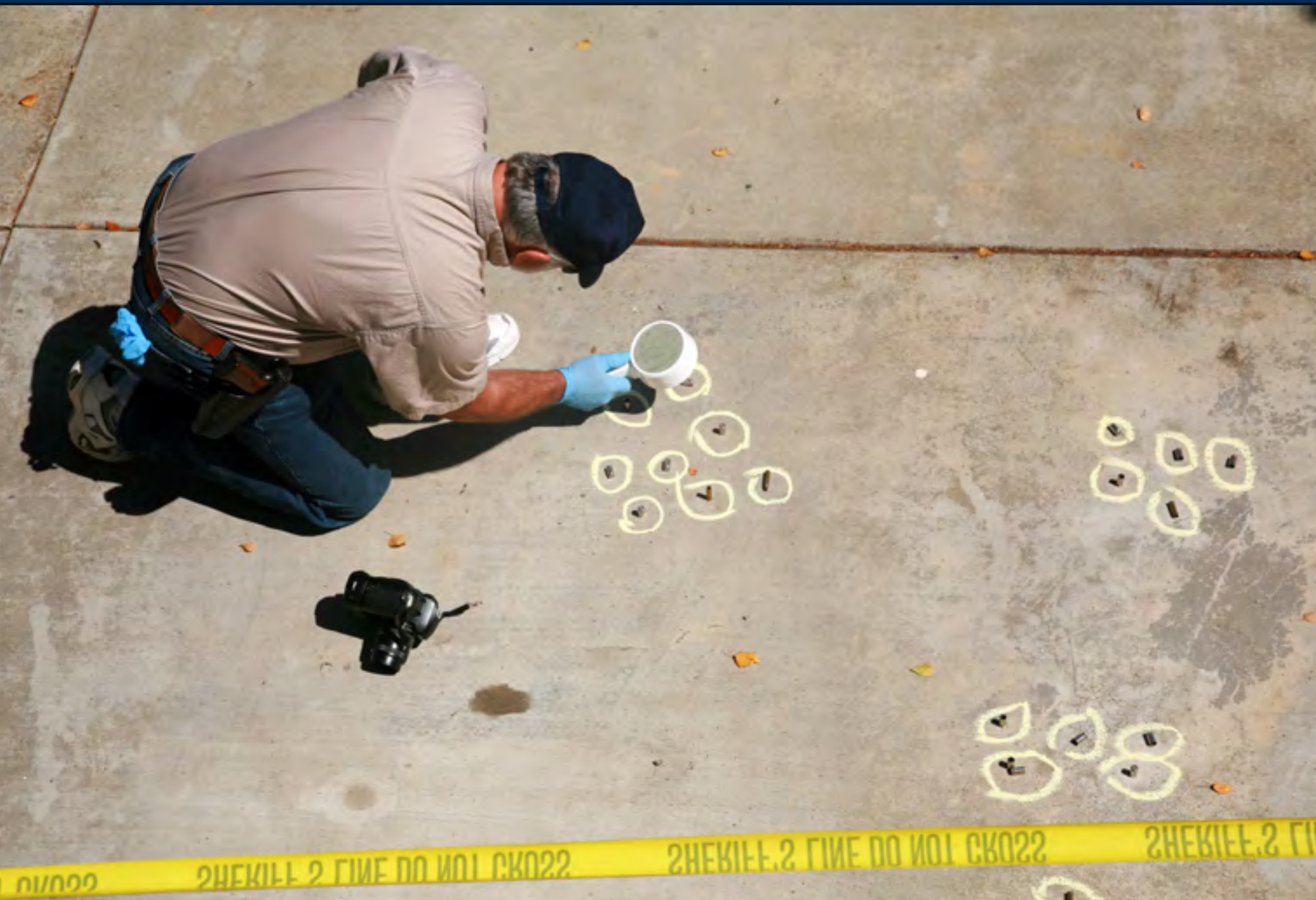
  Jopek, T.J. &Froeschle, Cl. (1997), Astronomy and Astrophysics, 320, 631

Algorithm

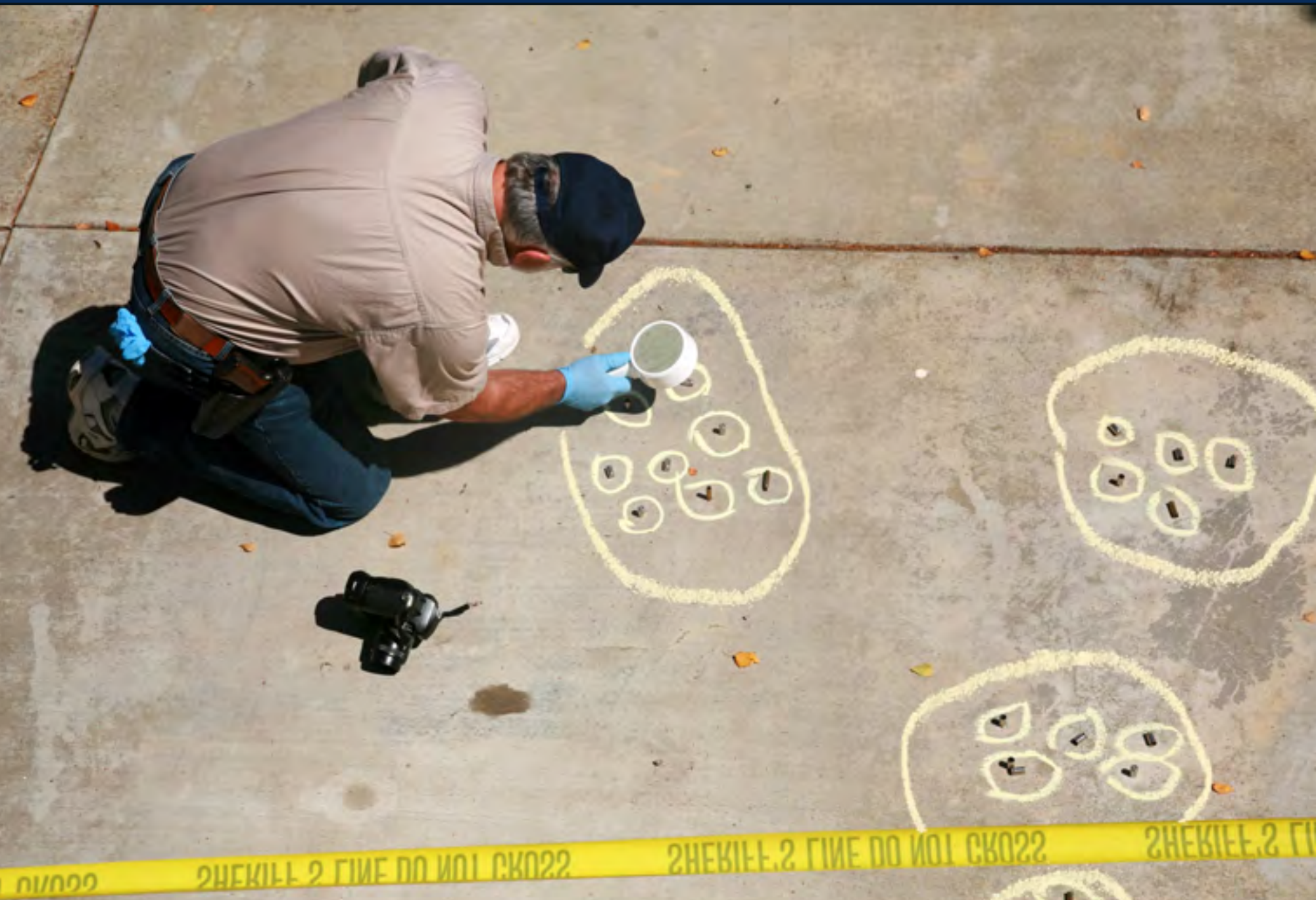
- Iterative methods
- Method of indices
- Single linking method
- Wavelet transform technique


EDMOND
14 years of activity
155 stations
144 751 meteor orbits

Independent identification method



Independent identification method

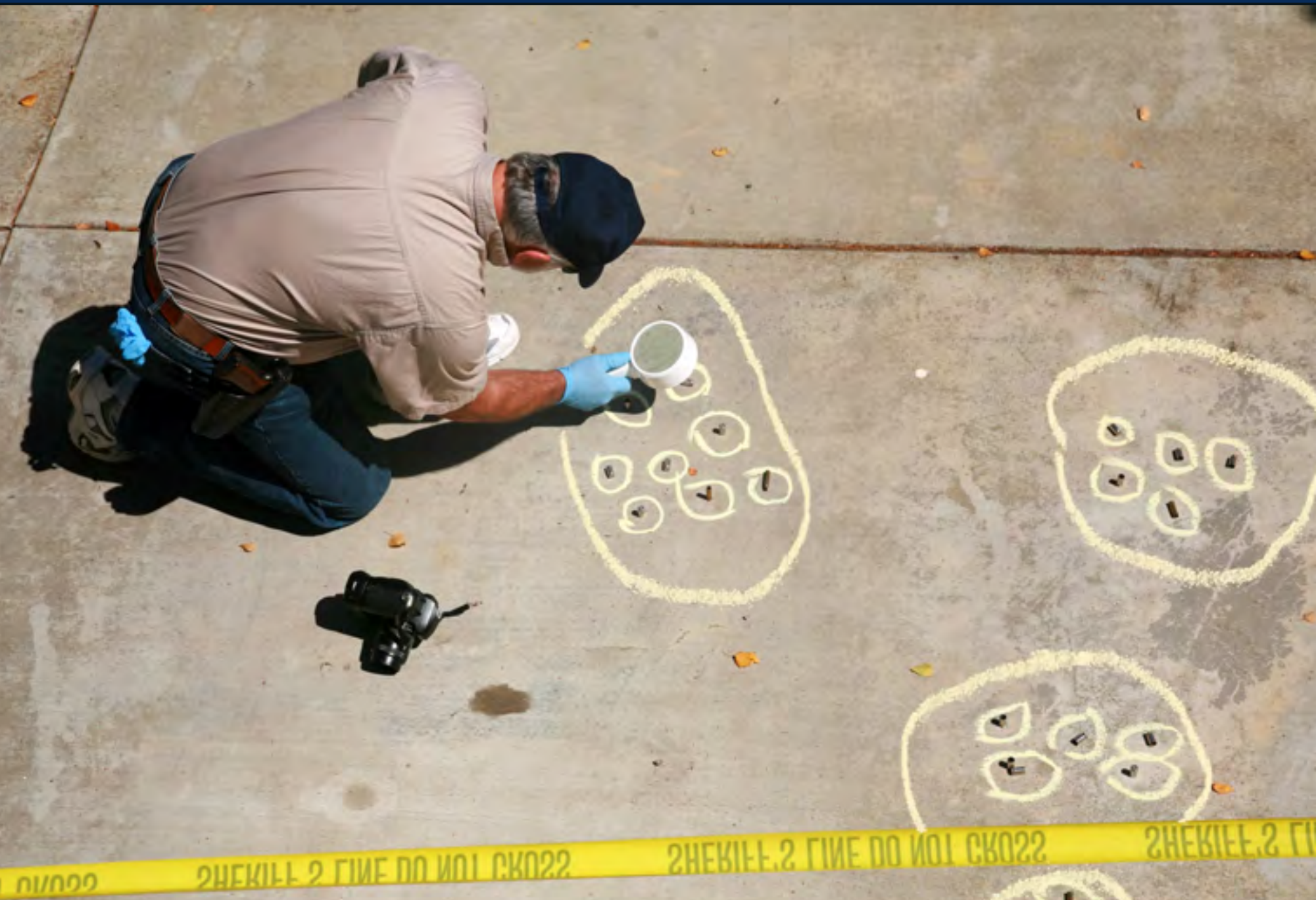


Independent identification method

$$
\begin{aligned}
D_x^2 &= w_\lambda \left[2 \cdot \sin \frac{(\lambda_A - \lambda_B)}{2} \right]^2 \\
&+ w_\alpha \left[(|V_{g_A} - V_{g_B}| + 1) \left(2 \cdot \sin \frac{(\alpha_A - \alpha_B)}{2} \cos \delta_A \right)^2 \right] \\
&+ w_\delta \left[(|V_{g_A} - V_{g_B}| + 1) \left(2 \cdot \sin \frac{(\delta_A - \delta_B)}{2} \right)^2 \right] \\
&+ w_v \frac{|V_{g_A} - V_{g_B}|}{V_{g_A}},
\end{aligned}
$$

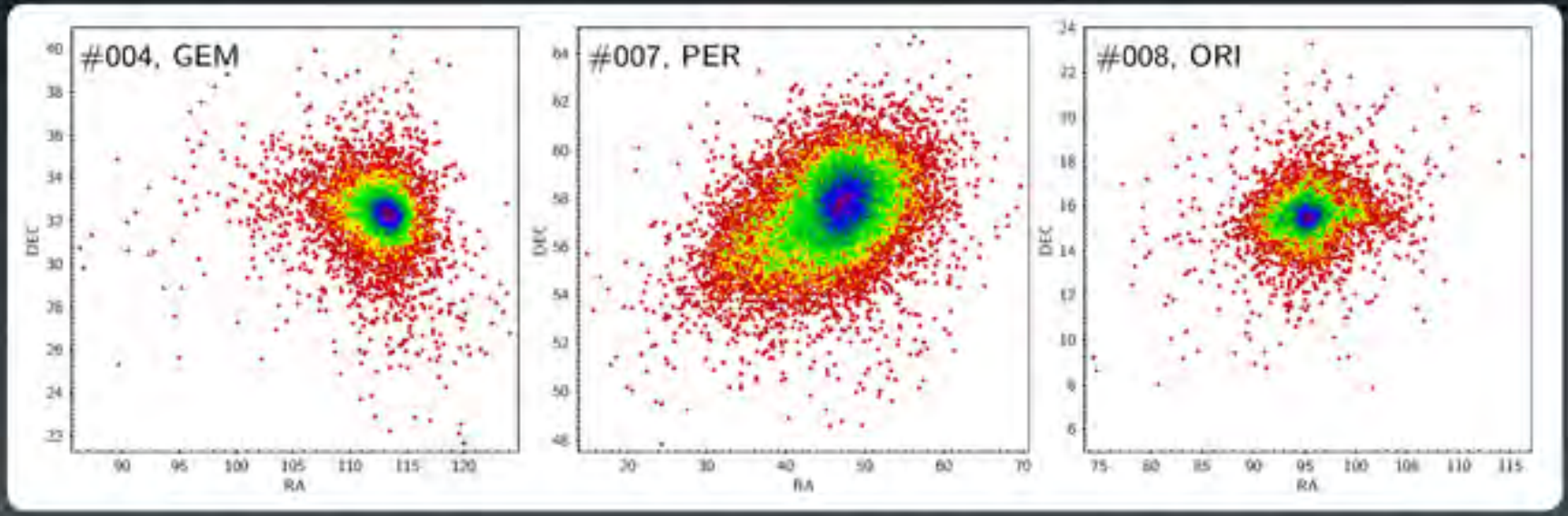
where $w_\lambda = 0.17$, $w_\alpha = 1.20$, $w_\delta = 1.20$, and $w_v = 0.20$.

Independent identification method



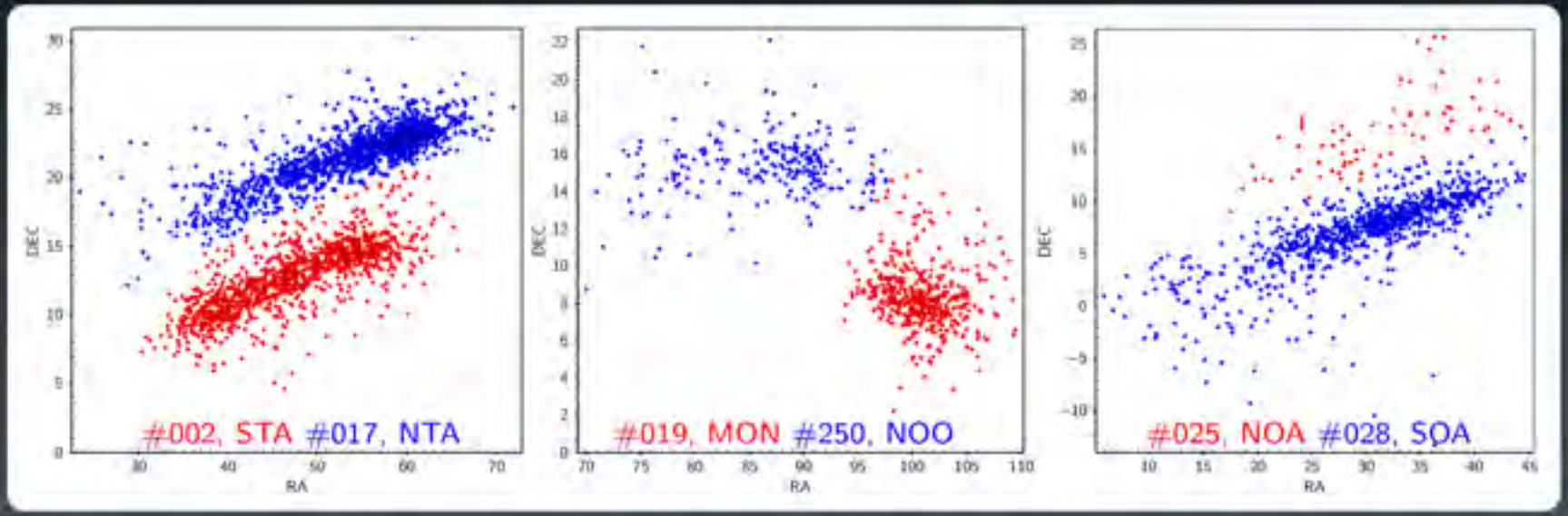
Independent identification method

Results



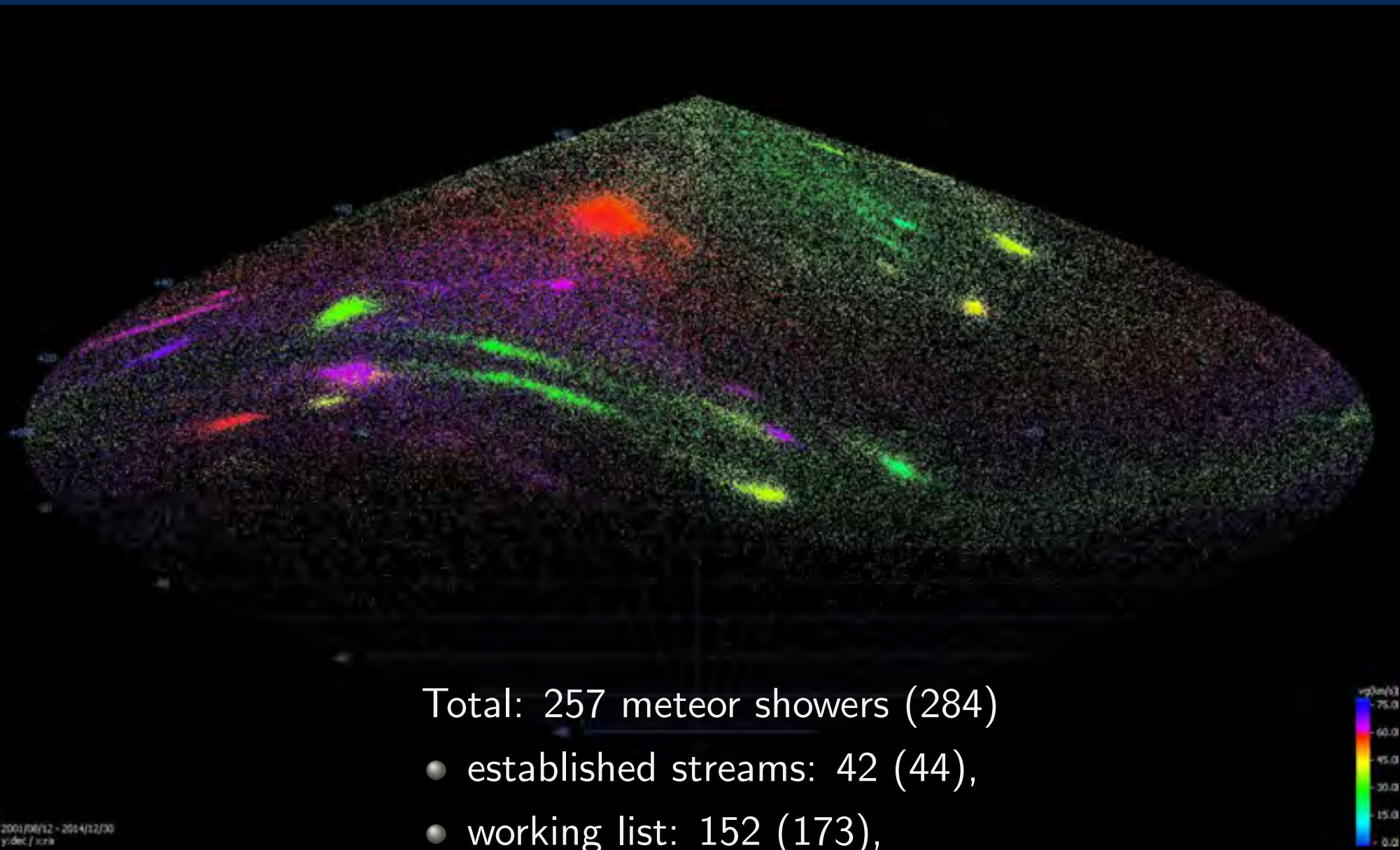
IAU	Code	$\lambda_\odot$	α	δ	V_g	No	D_{SH}
004	GEM	261.67	113.05	32.36	33.51	8268	0.03
007	PER	139.48	46.75	57.62	58.27	17265	0.10
008	ORI	208 14	95.36	15 58	65.46	5228	0 04

Results



IAU	Code	$\lambda_\odot$	α	δ	V_g	No	D_{SH}
002	STA	215.33	47.10	12.89	27.62	1155	0.02
017	NTA	225.77	55.33	22.07	27.91	1403	0.01
019	MON	258.77	100.68	8.24	40.98	467	0.03
250	NOO	243.41	88.07	15.43	42.54	233	0.05
025	NOA	195.74	31.01	16.55	33.31	74	0.13
028	SOA	195.03	30.84	7.75	28.06	903	0.08

Conclusions



Total: 257 meteor showers (284)

- established streams: 42 (44),
- working list: 152 (173),
- *pro-tempore*: 63 (67).


Thank You
For Your Attention!