Friedrich-Alexander-Universität
Erlangen-Nürnberg

IceCube Masterclass

Punktquellenanalyse

Deborah Roser

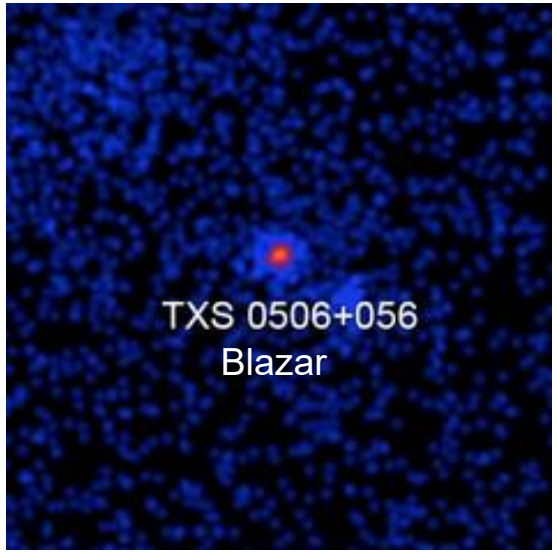
Himmelsobjekte



Quelle: NASA



Quelle: Max-Planck-Institut



Quelle: NASA

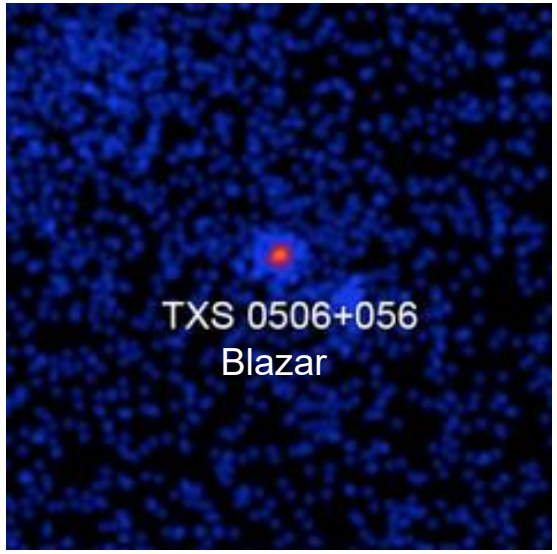


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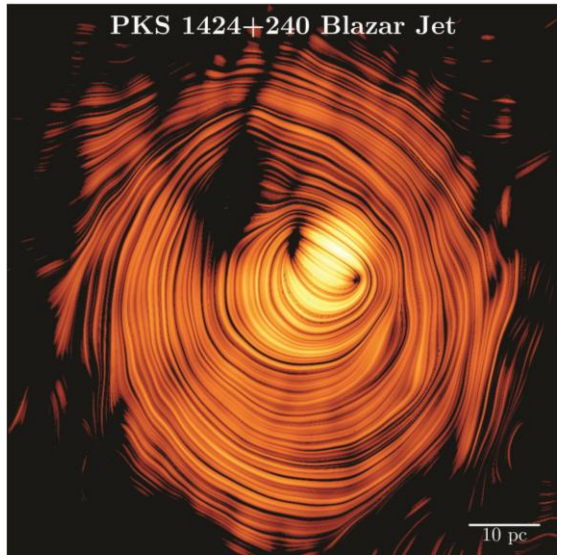
Himmelsobjekte



Quelle: NASA



Quelle: NASA



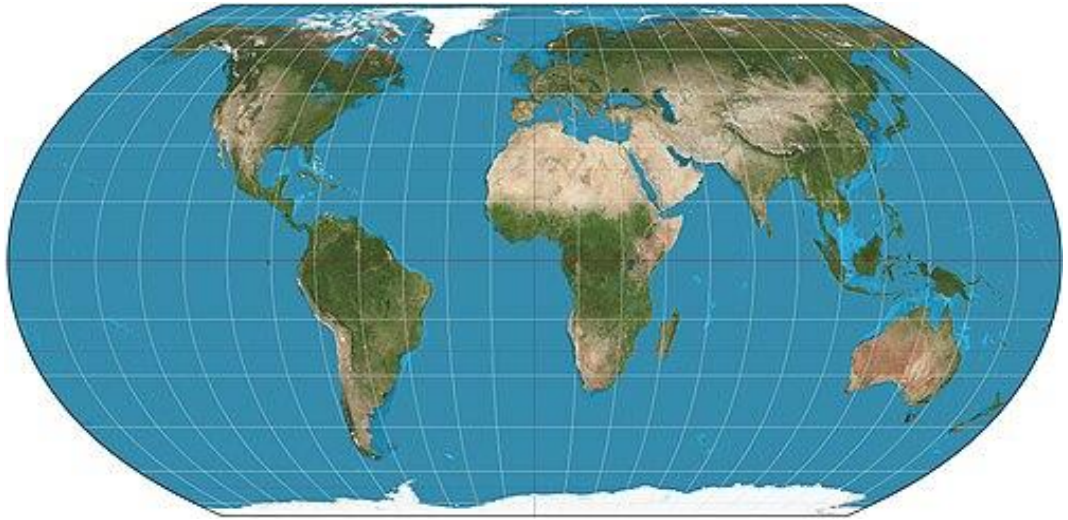
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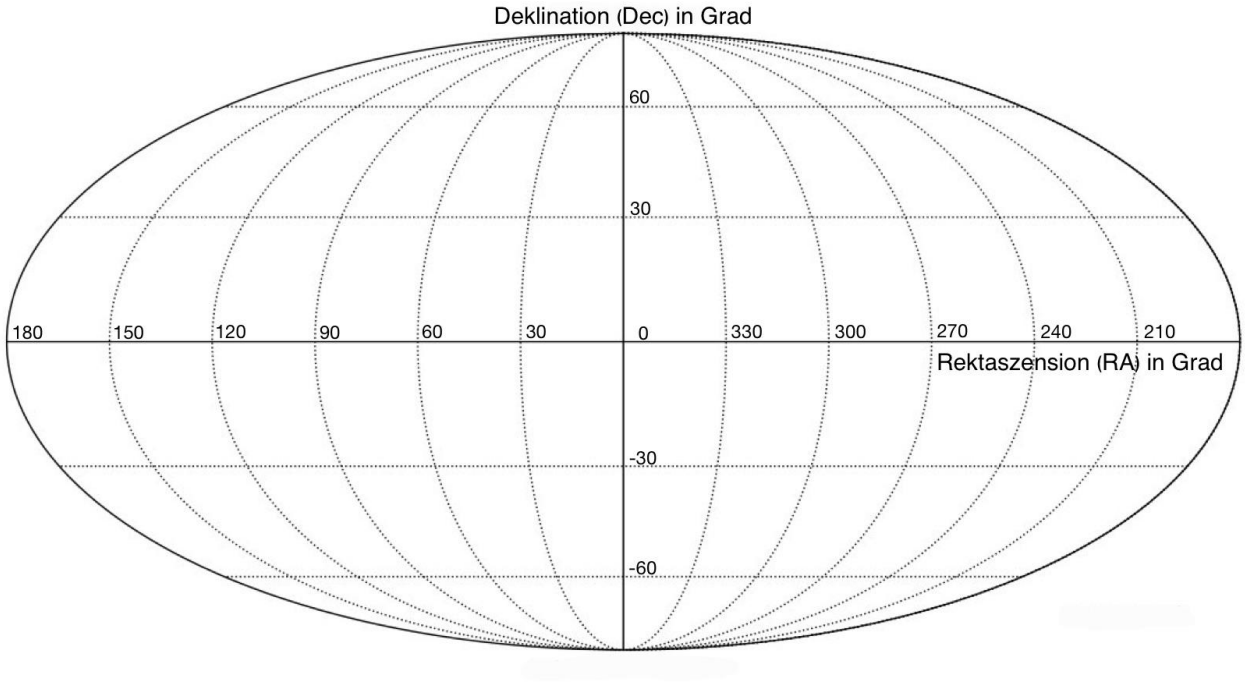
Wo im Himmel befinden sich diese 4 Objekte?



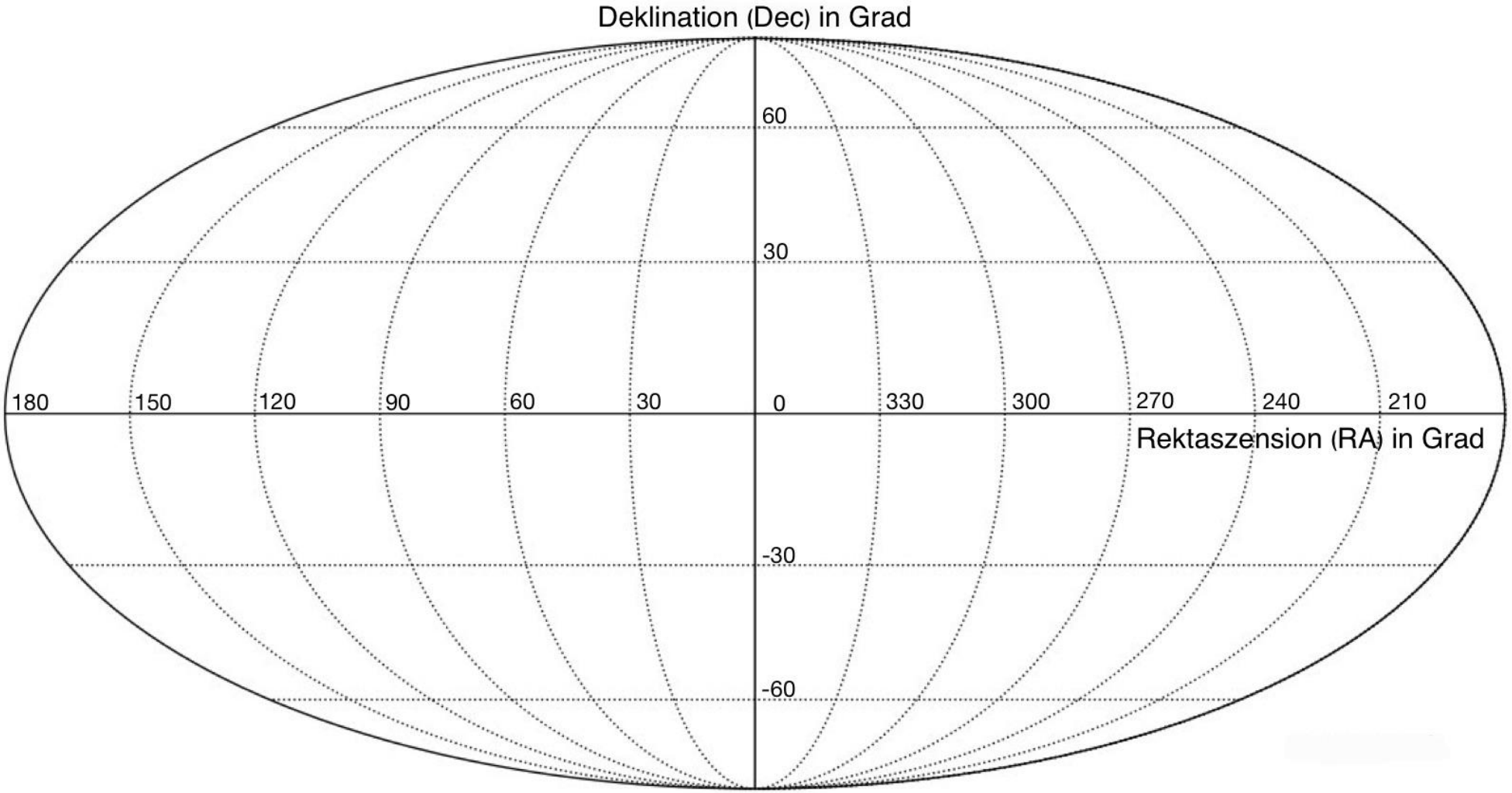
Quelle: NASA

Himmelskarte

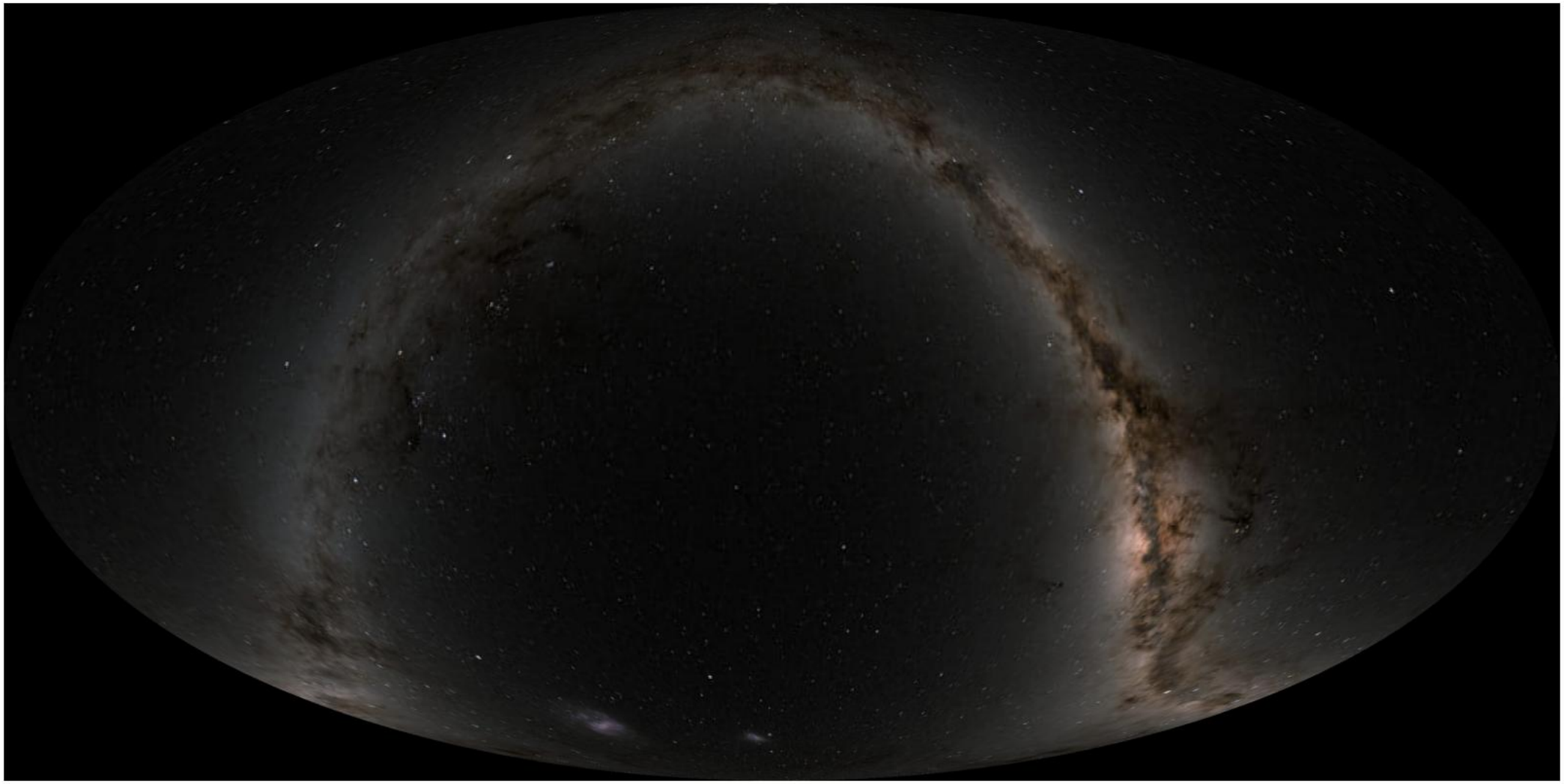




Himmelskarte



Himmelskarte

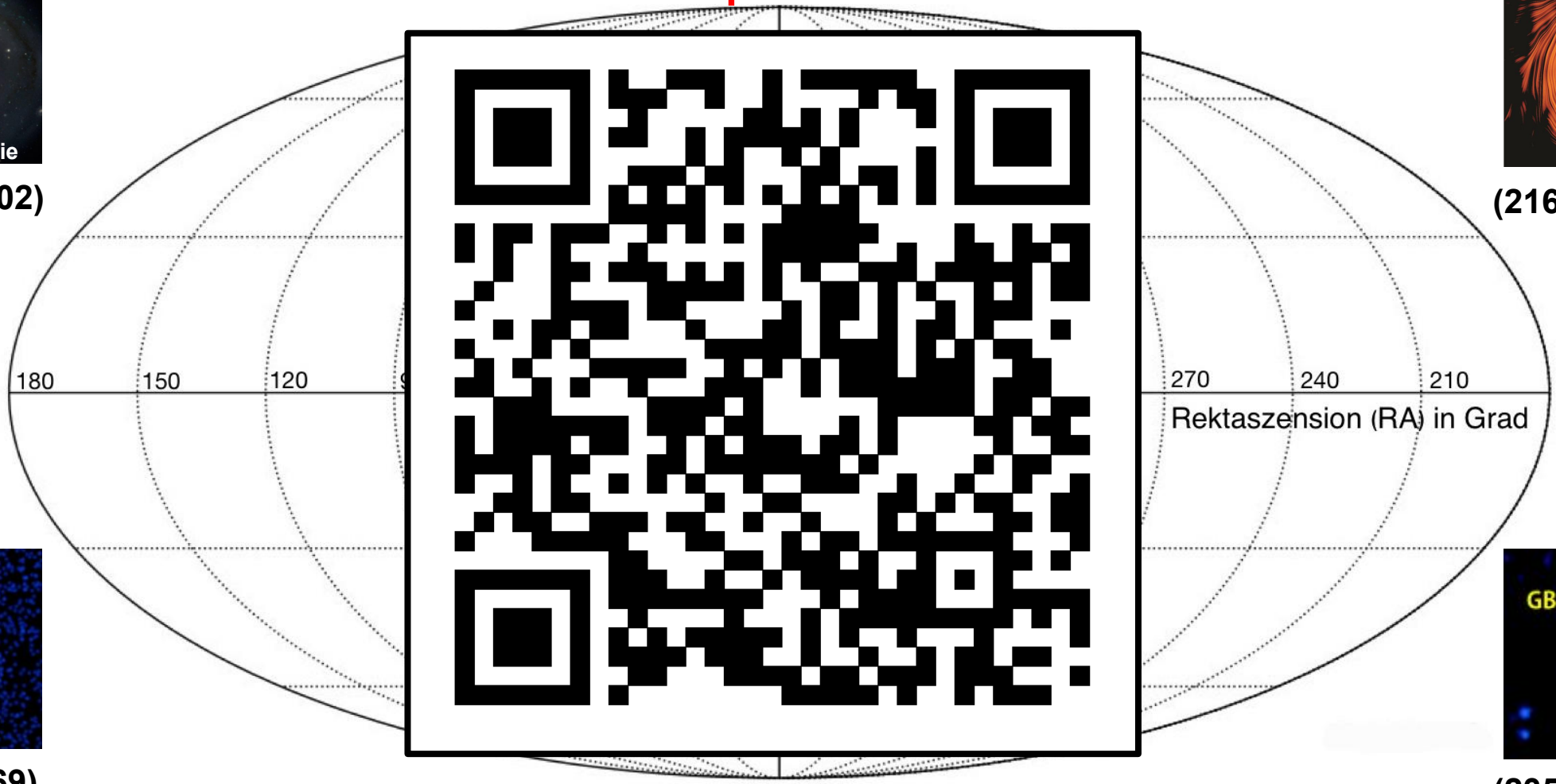


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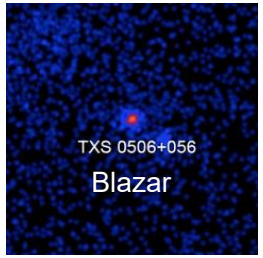
(40,67| -0,02)

Passwort: ecapmasterclass2026





(216,75| 23,80)



(77,42| 5,69)



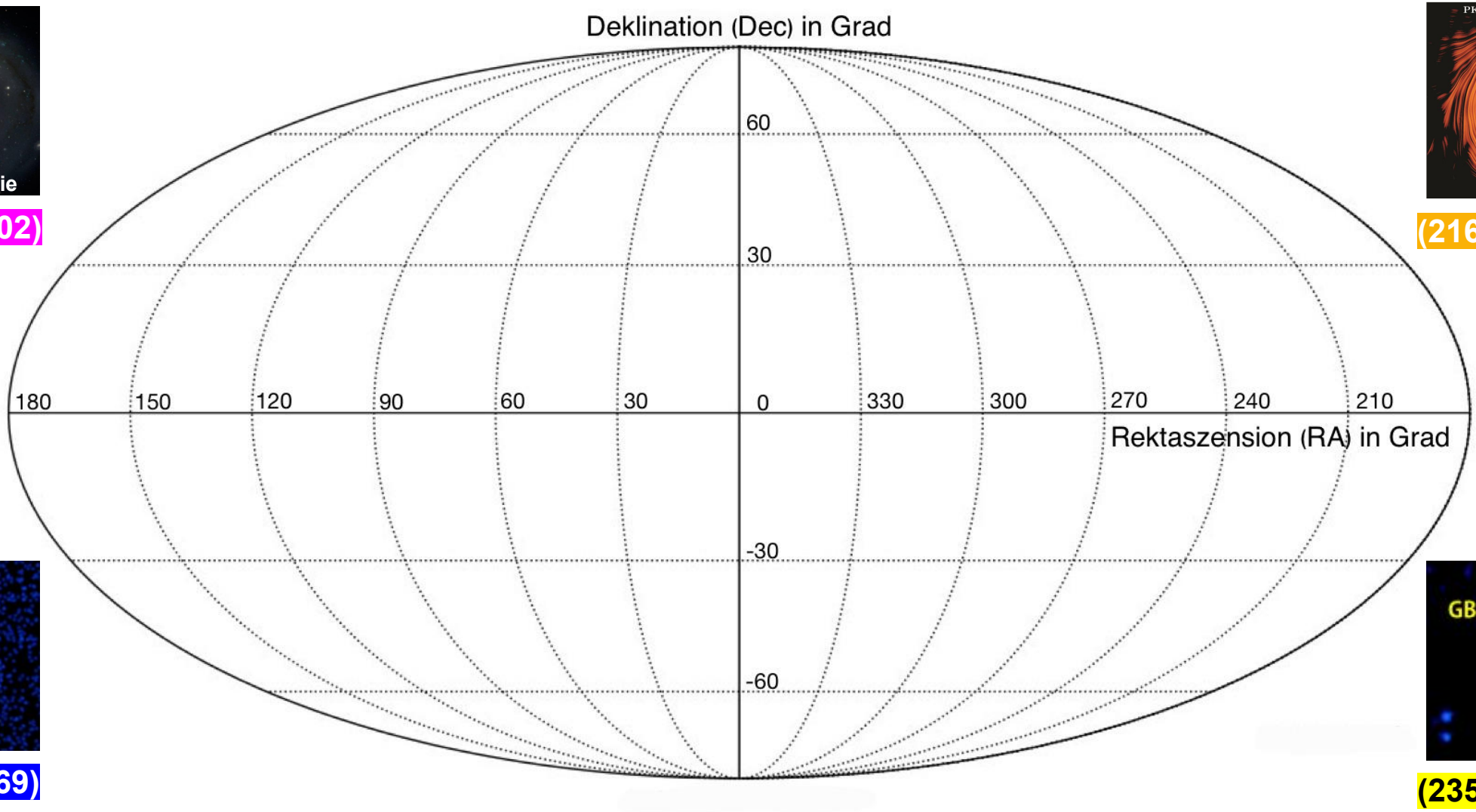
(235,74| 61,50)

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Himmelskarte

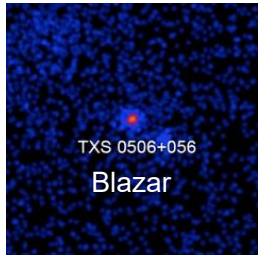


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(216,75| 23,80)

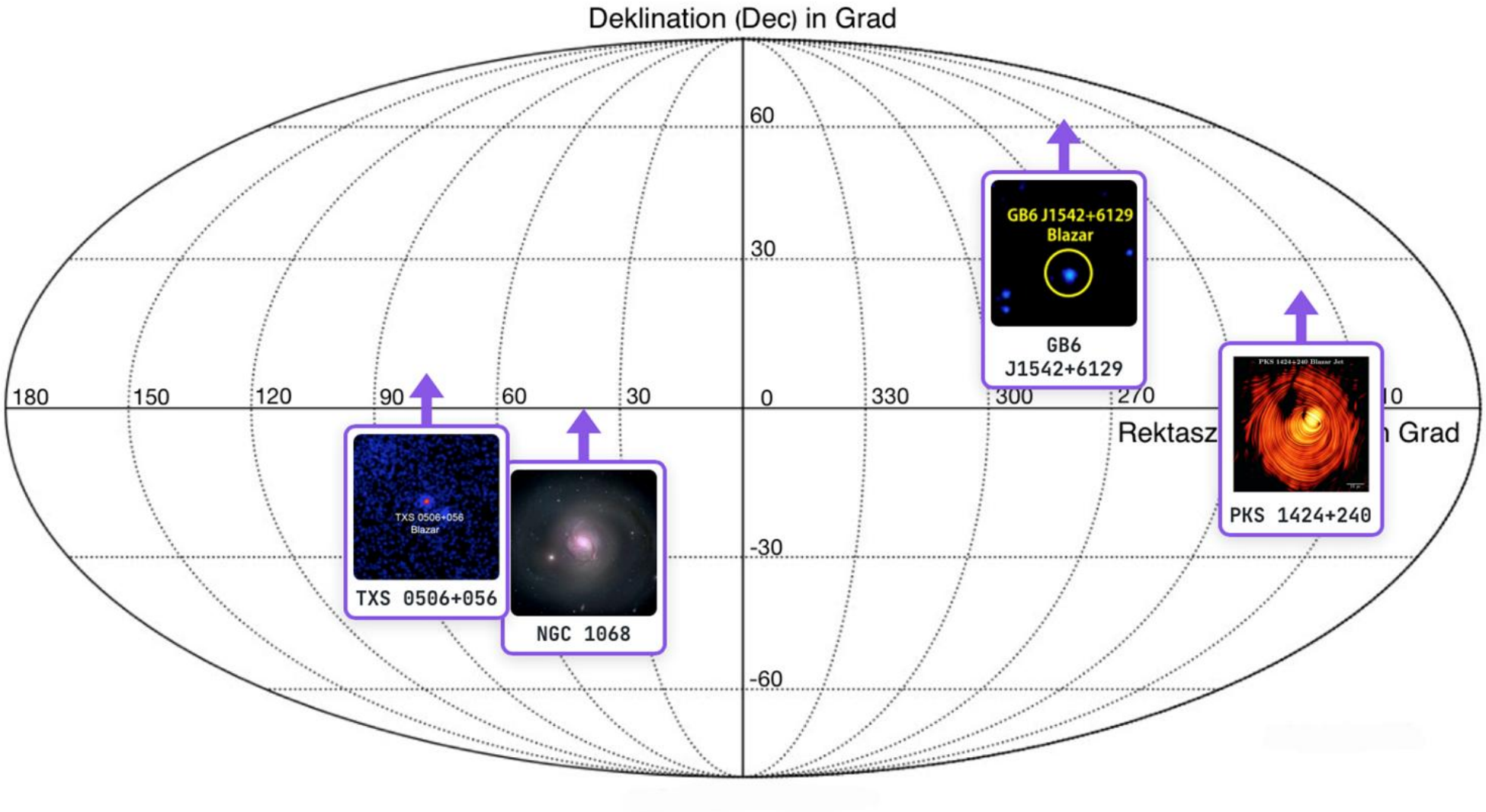


(77,42| 5,69)



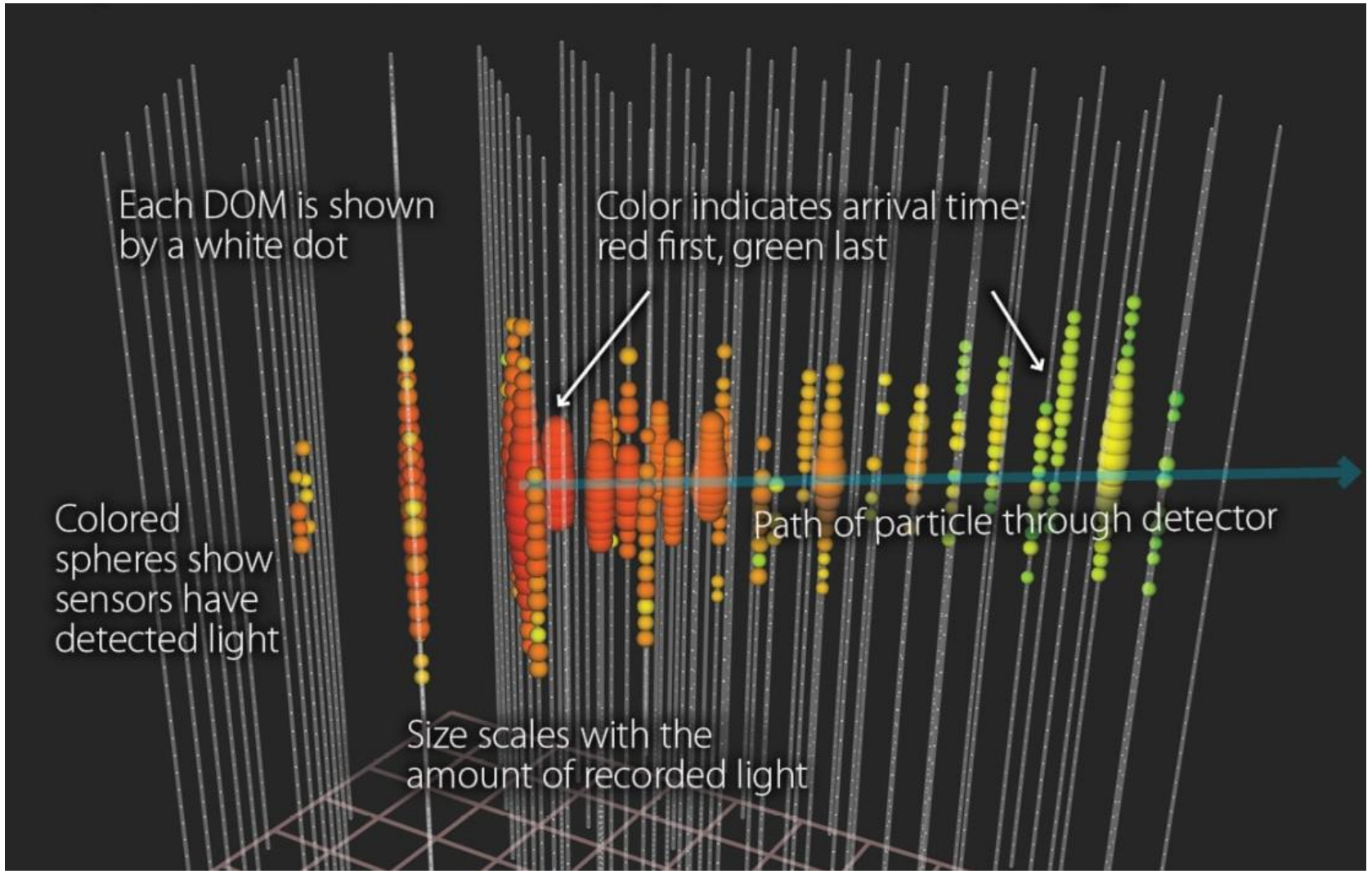
(235,74| 61,50)

Himmelskarte



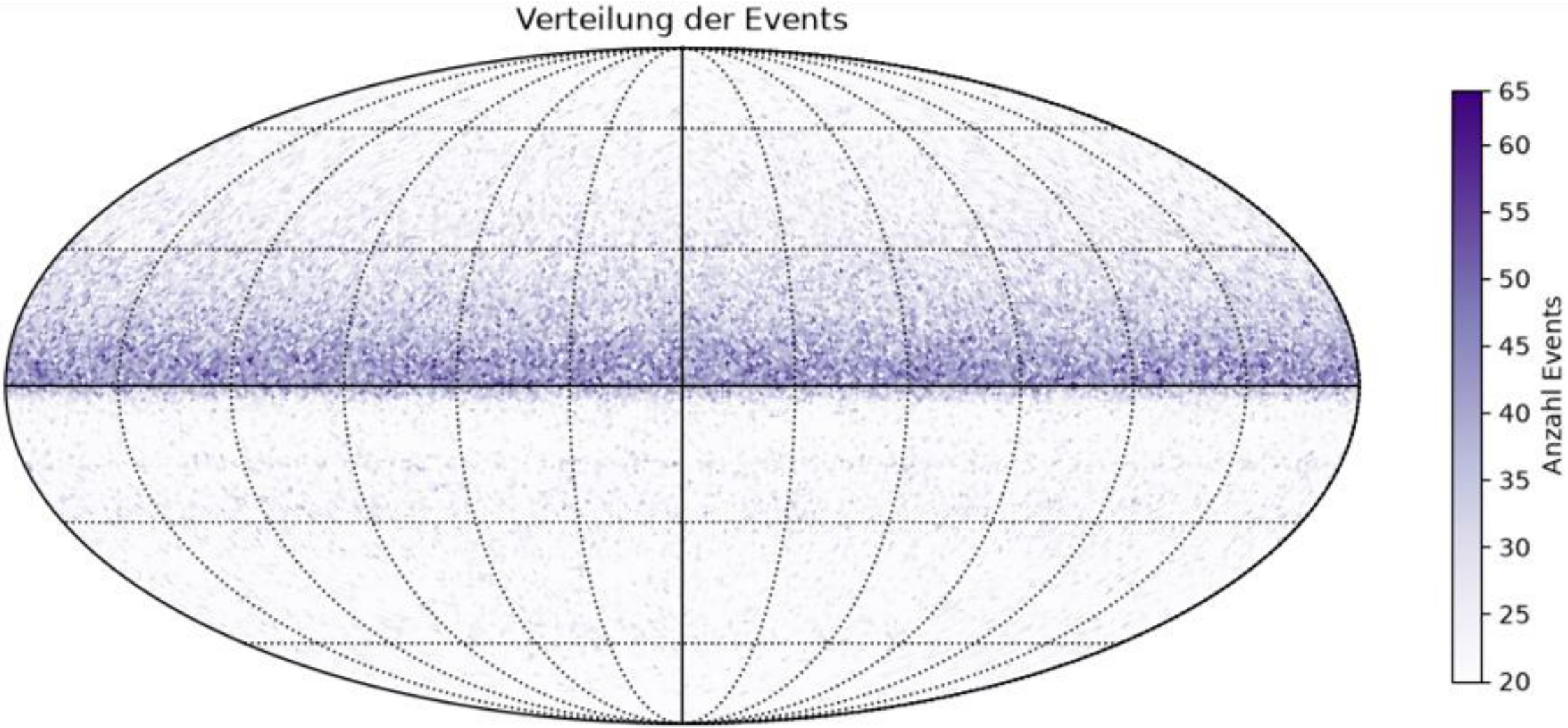
Event – Himmelskarte

Dr. Strangepork
(110| -0,04)



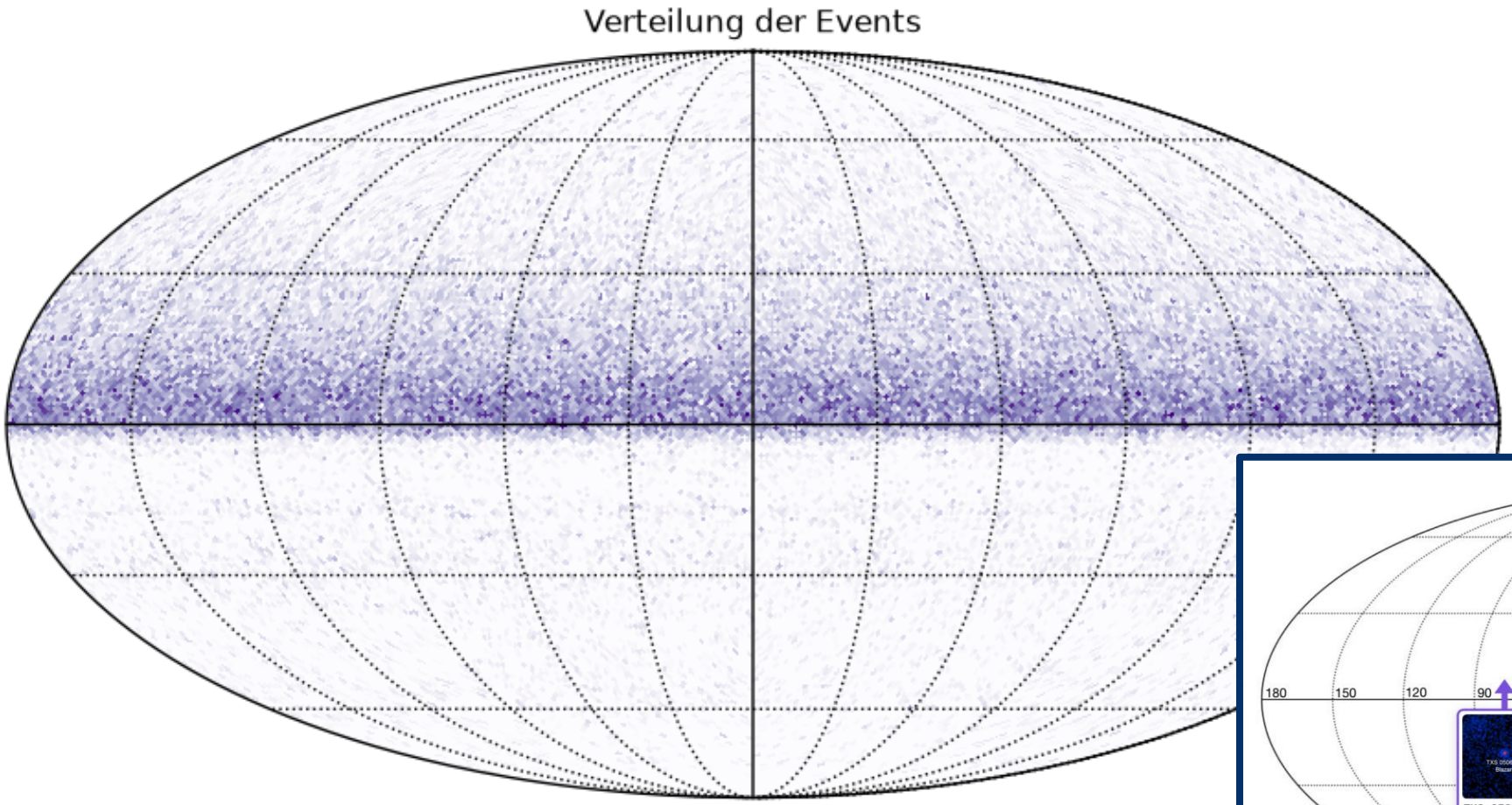
Neutrino Himmelskarte

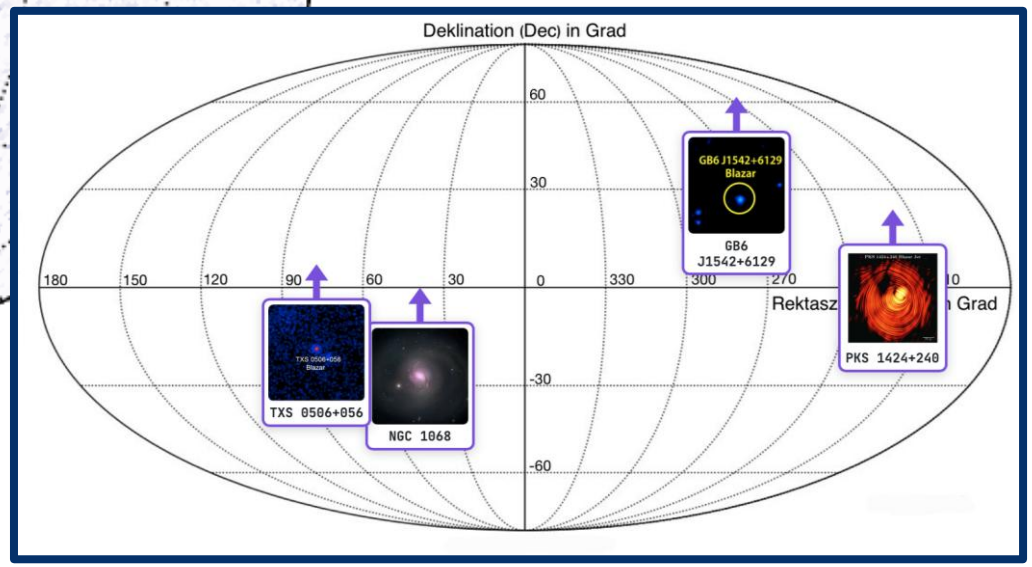
Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Neutrino Himmelskarte

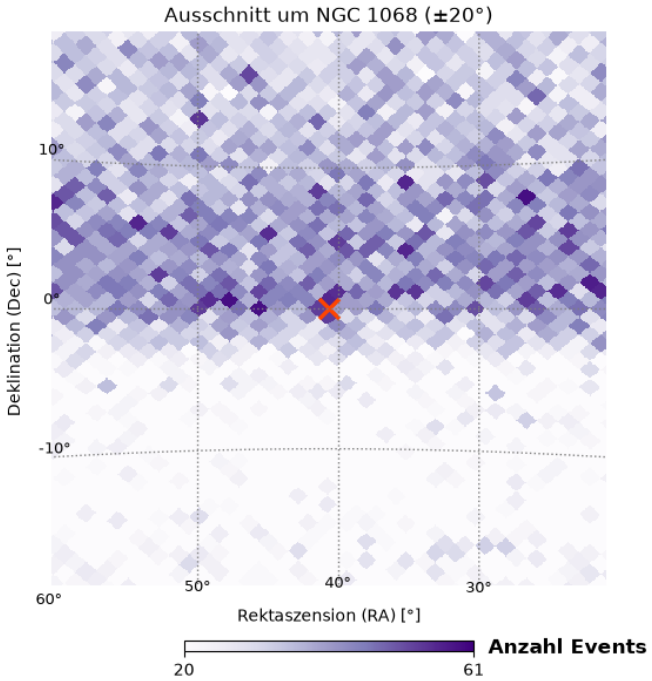
Events in einer Himmelskarte – erkennen wir einen Zusammenhang?

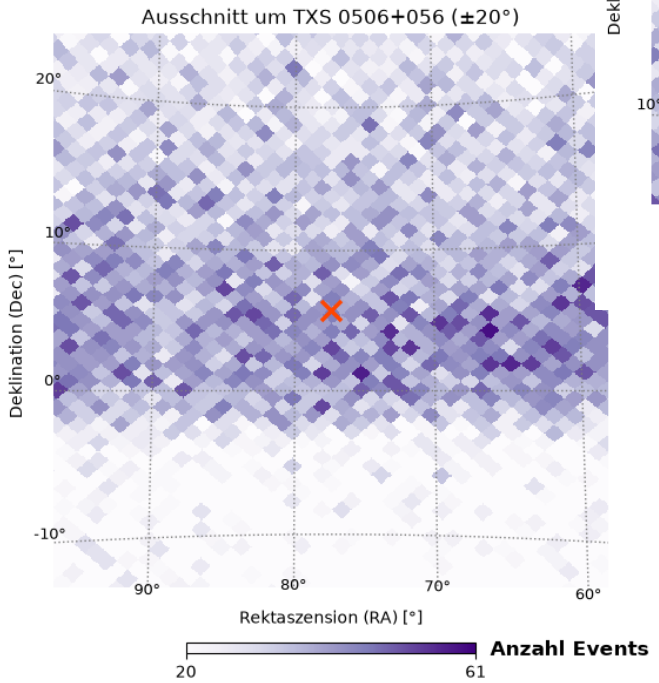


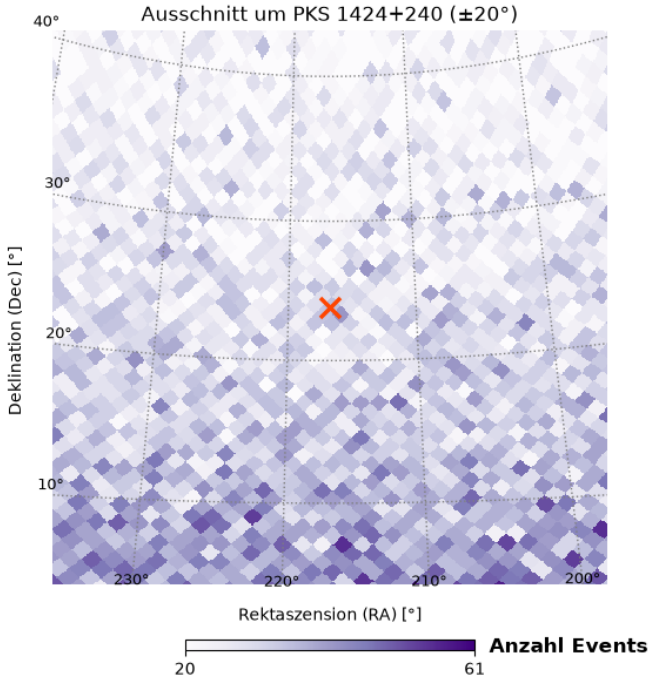


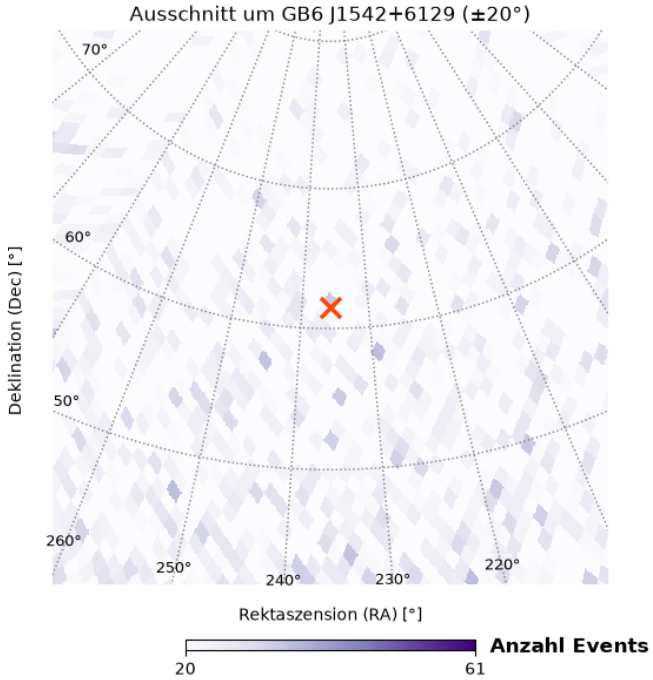
Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



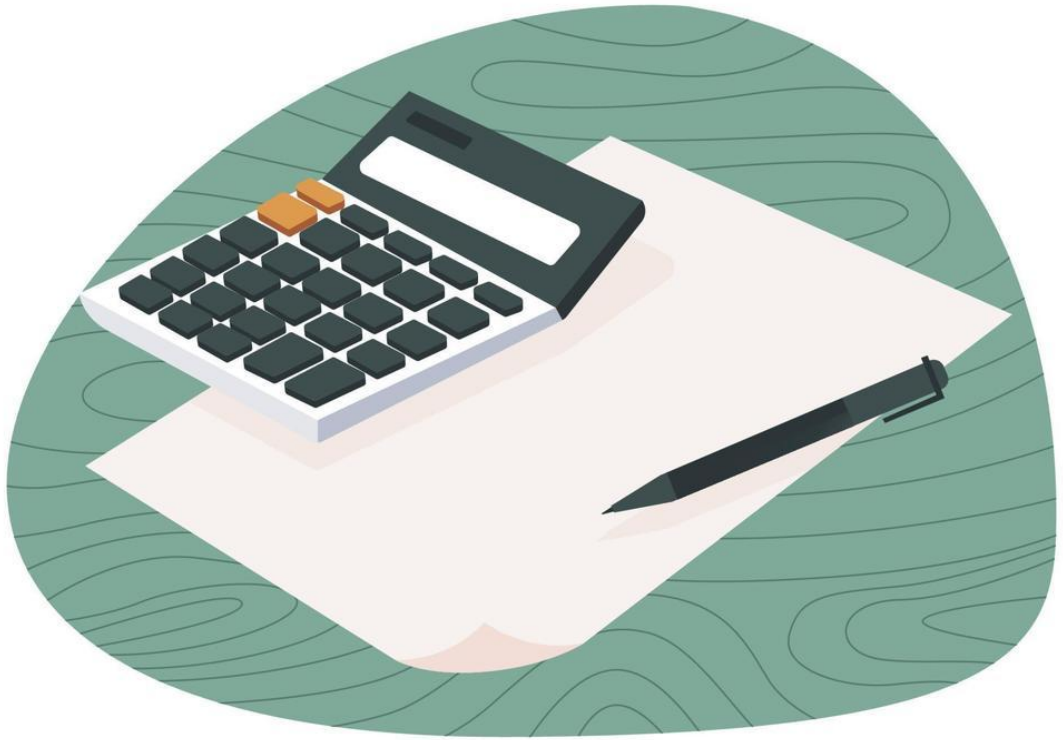






Datenanalyse

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



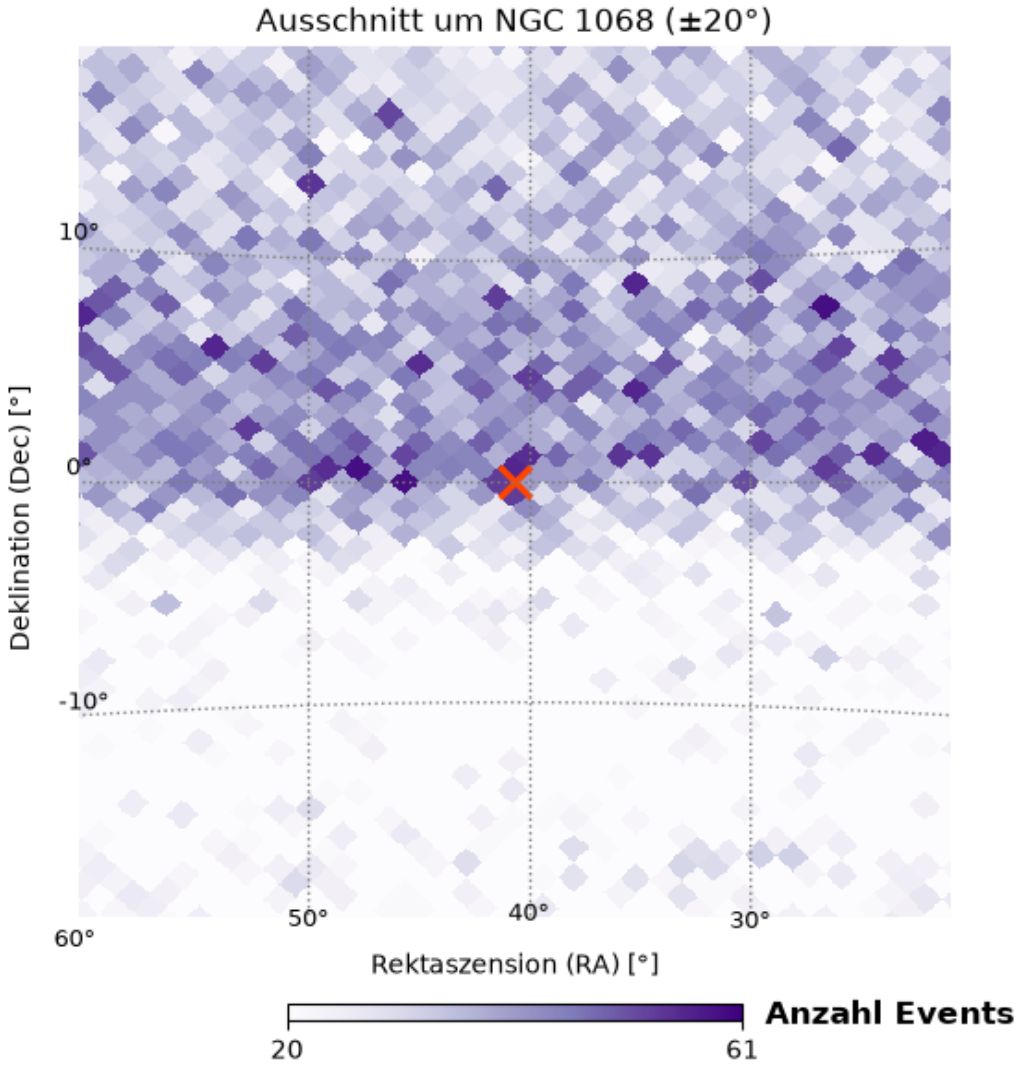


Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Quelle: NASA



Neutrino Himmelskarte & Nullhypothese

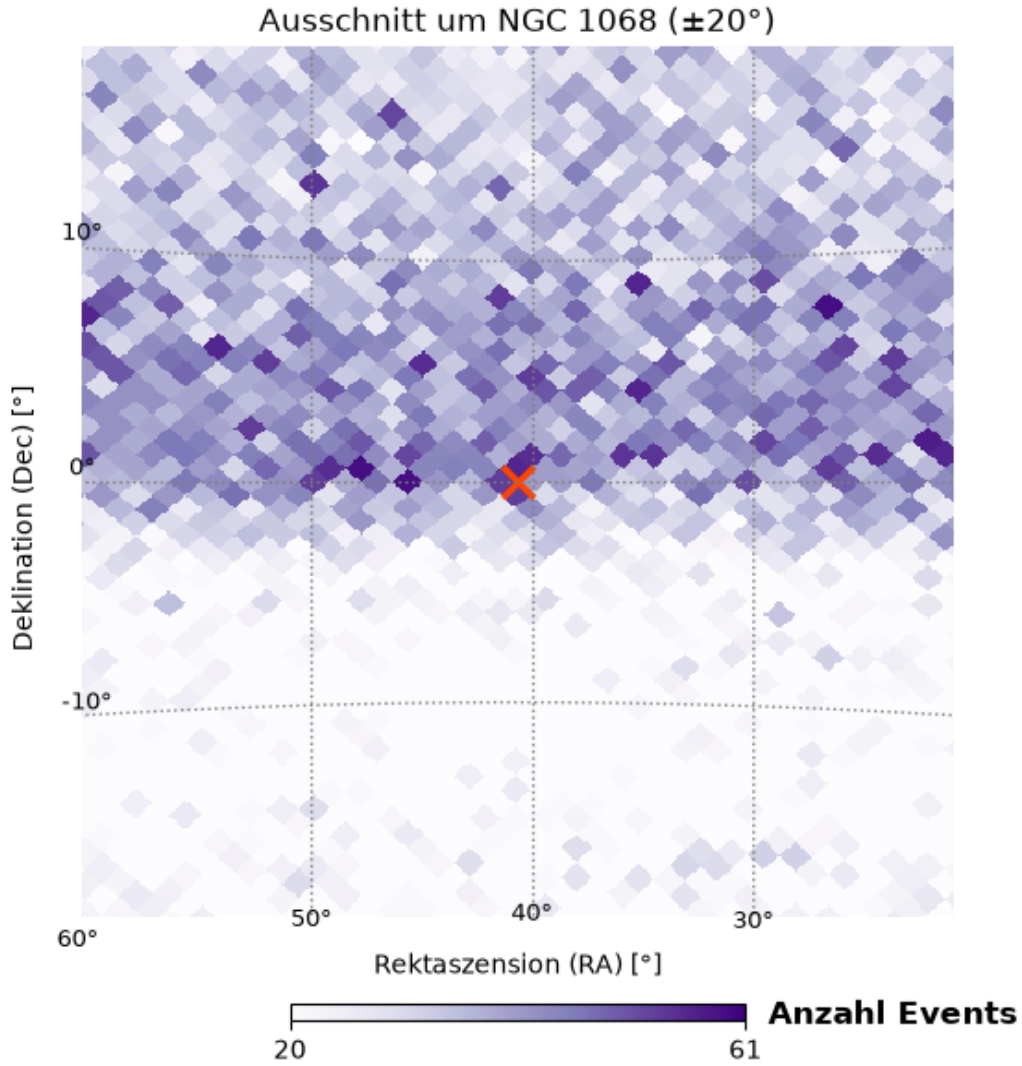
Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Quelle: NASA



!? Nullhypothese ?!



Nullhypothese

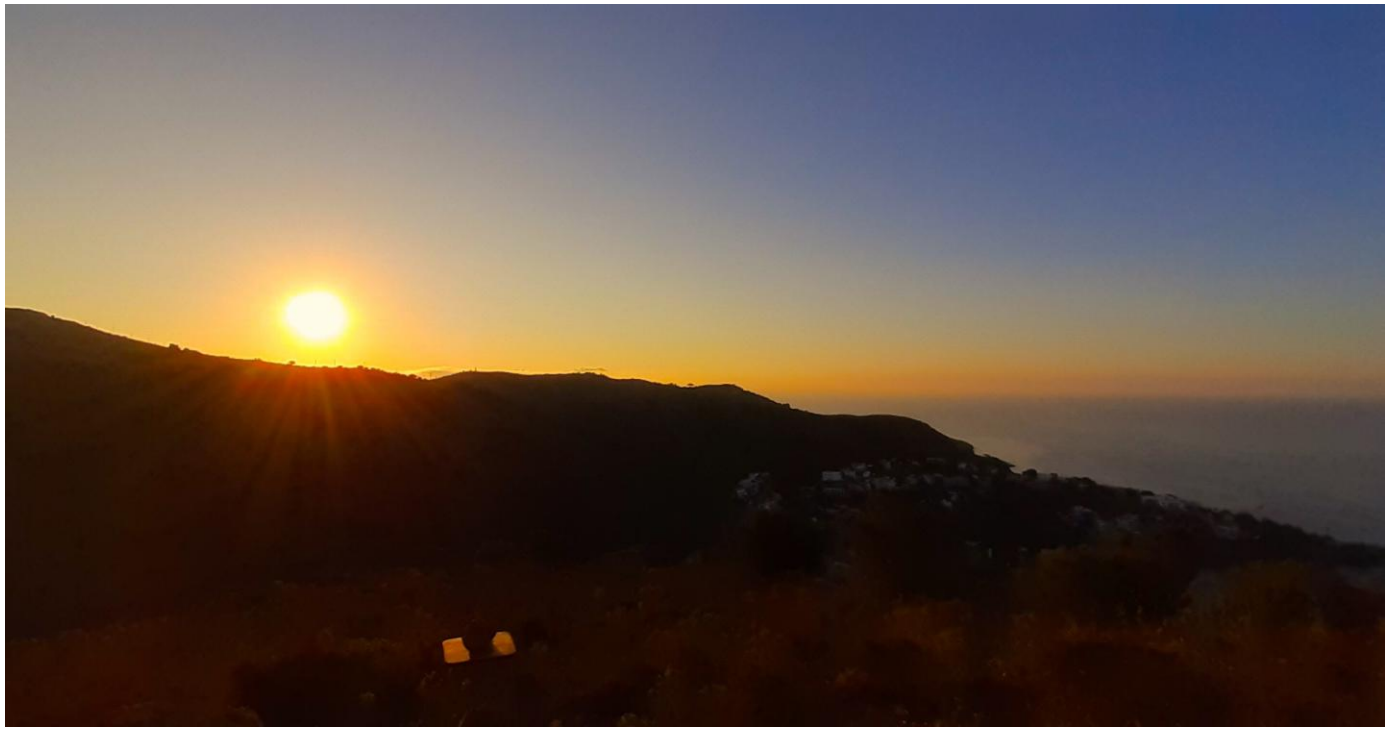


Nullhypothese:

Morgen geht nicht die Sonne auf.

Wissenschaftliche Antwort:

Mit einer sehr geringen Wahrscheinlichkeit von nahe 0% geht die Sonne morgen nicht auf.



Neutrino Himmelskarte & Nullhypothese

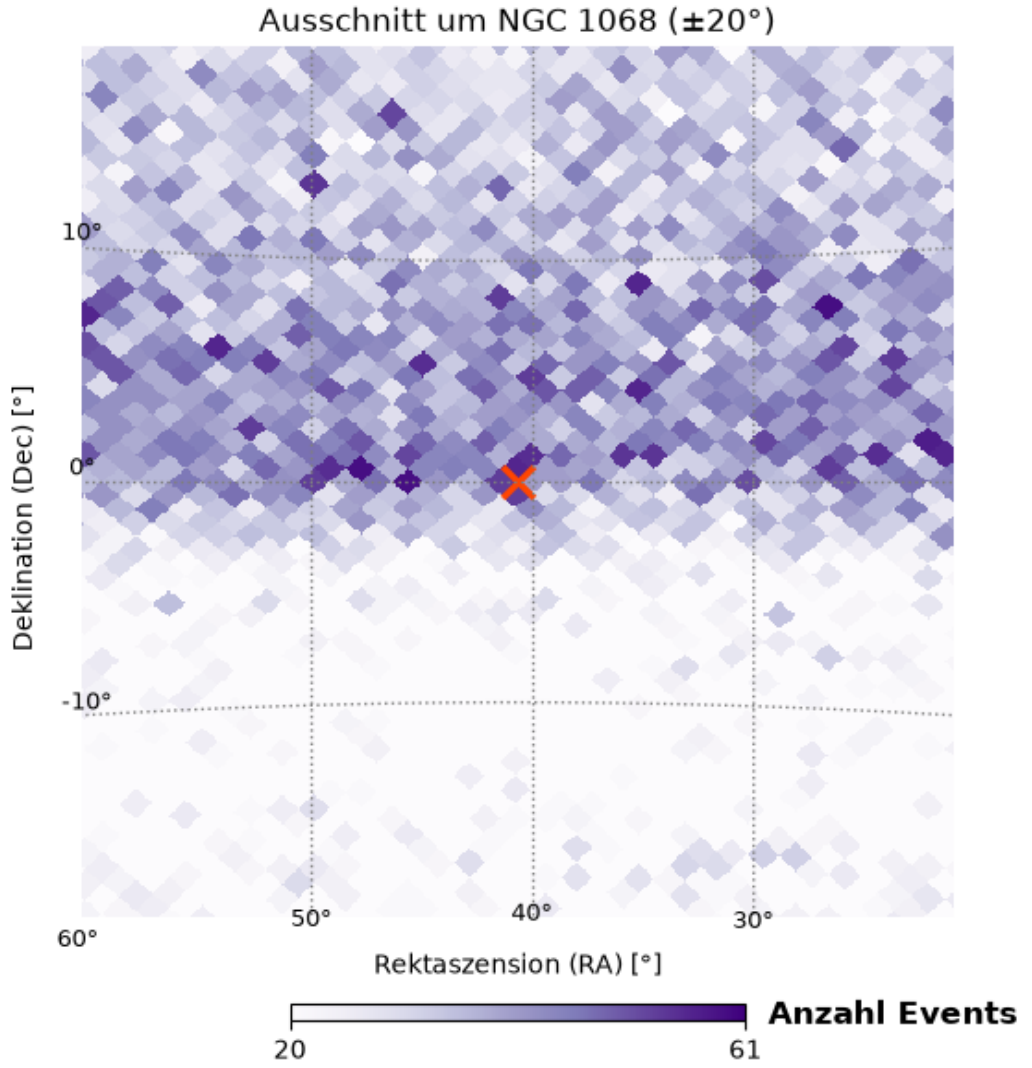
Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Quelle: NASA



Nullhypothese



Neutrino Himmelskarte & Nullhypothese

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?

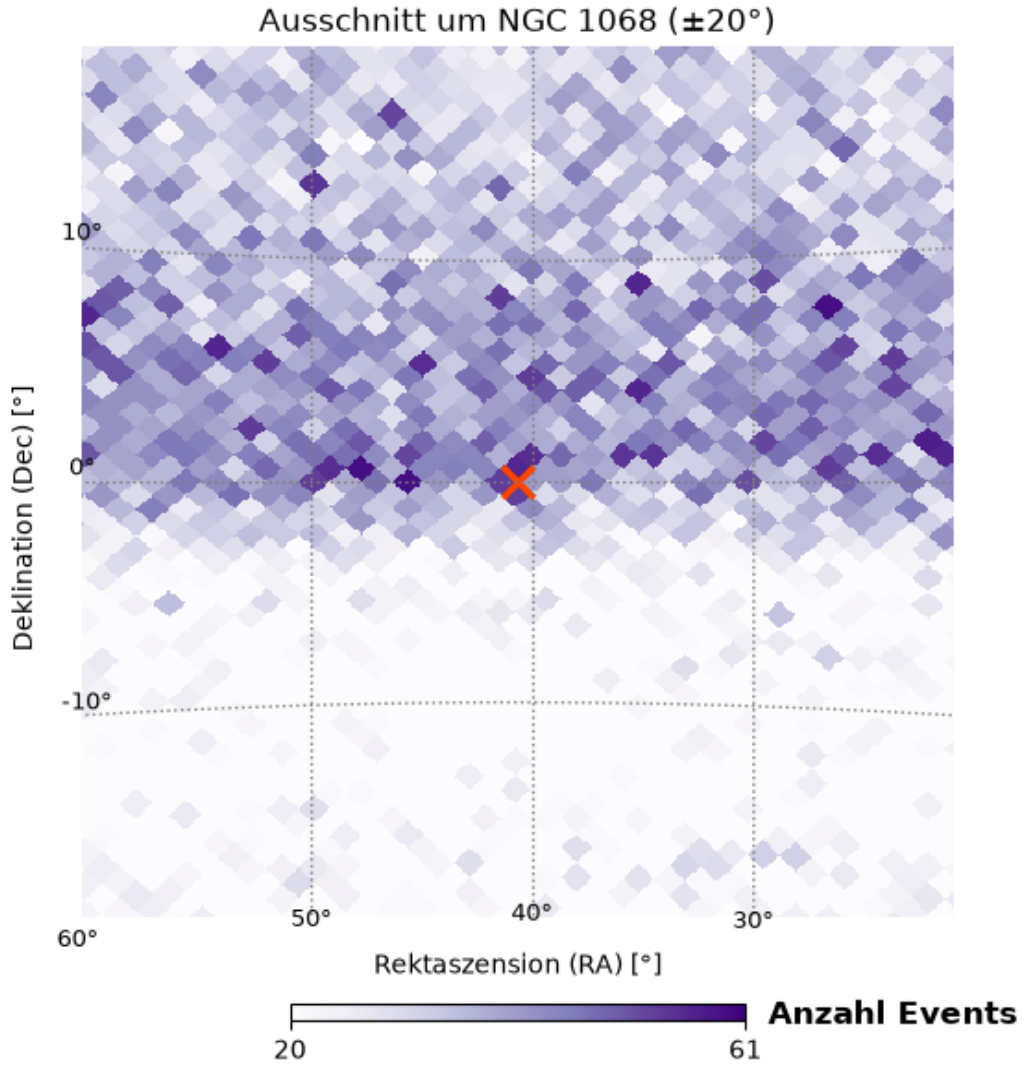


Quelle: NASA



Nullhypothese

NGC 1068 ist keine Neutrino Quelle.



Neutrino Himmelskarte & Nullhypothese

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



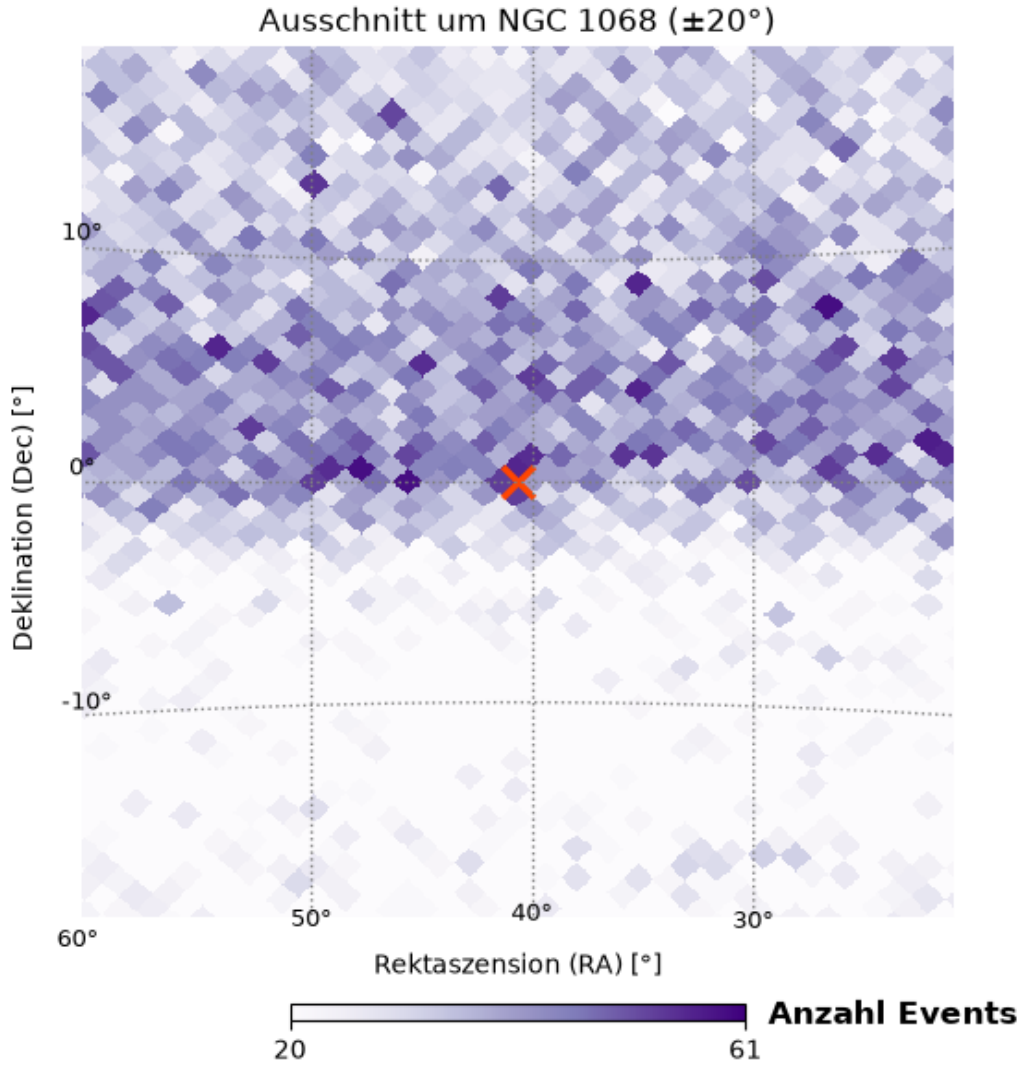
Quelle: NASA



Wie prüfen wir unsere Nullhypothese?

Nullhypothese

NGC 1068 ist keine Neutrino Quelle.

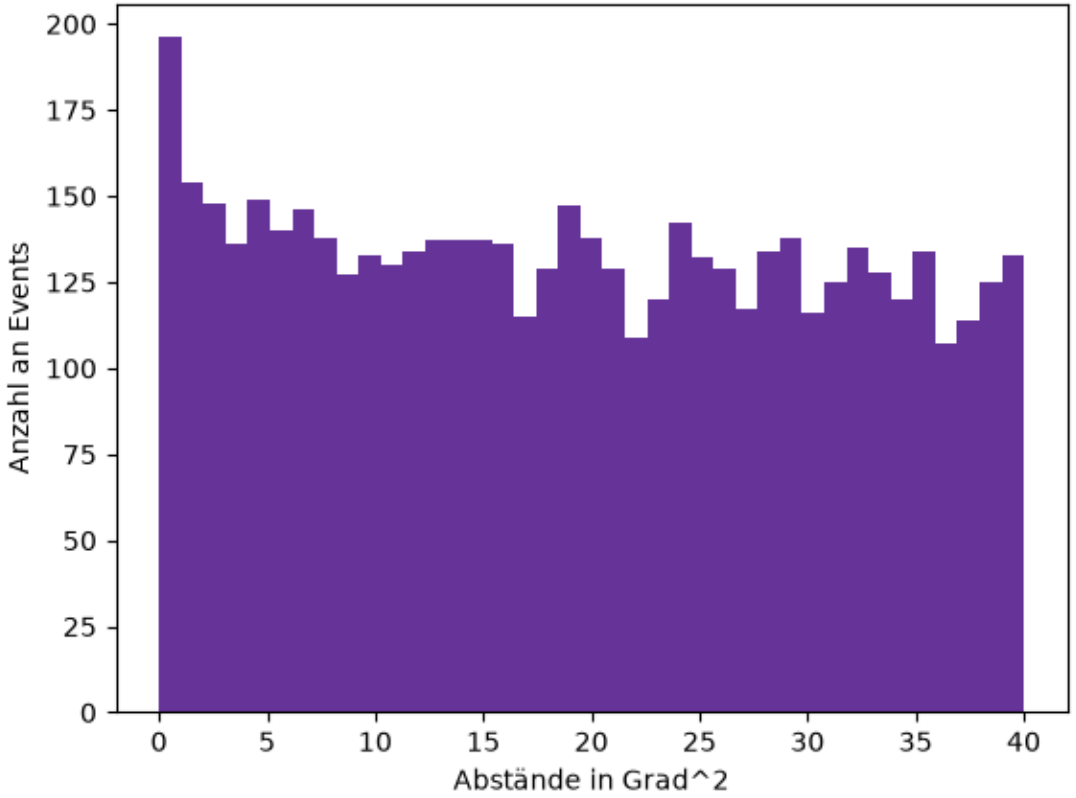


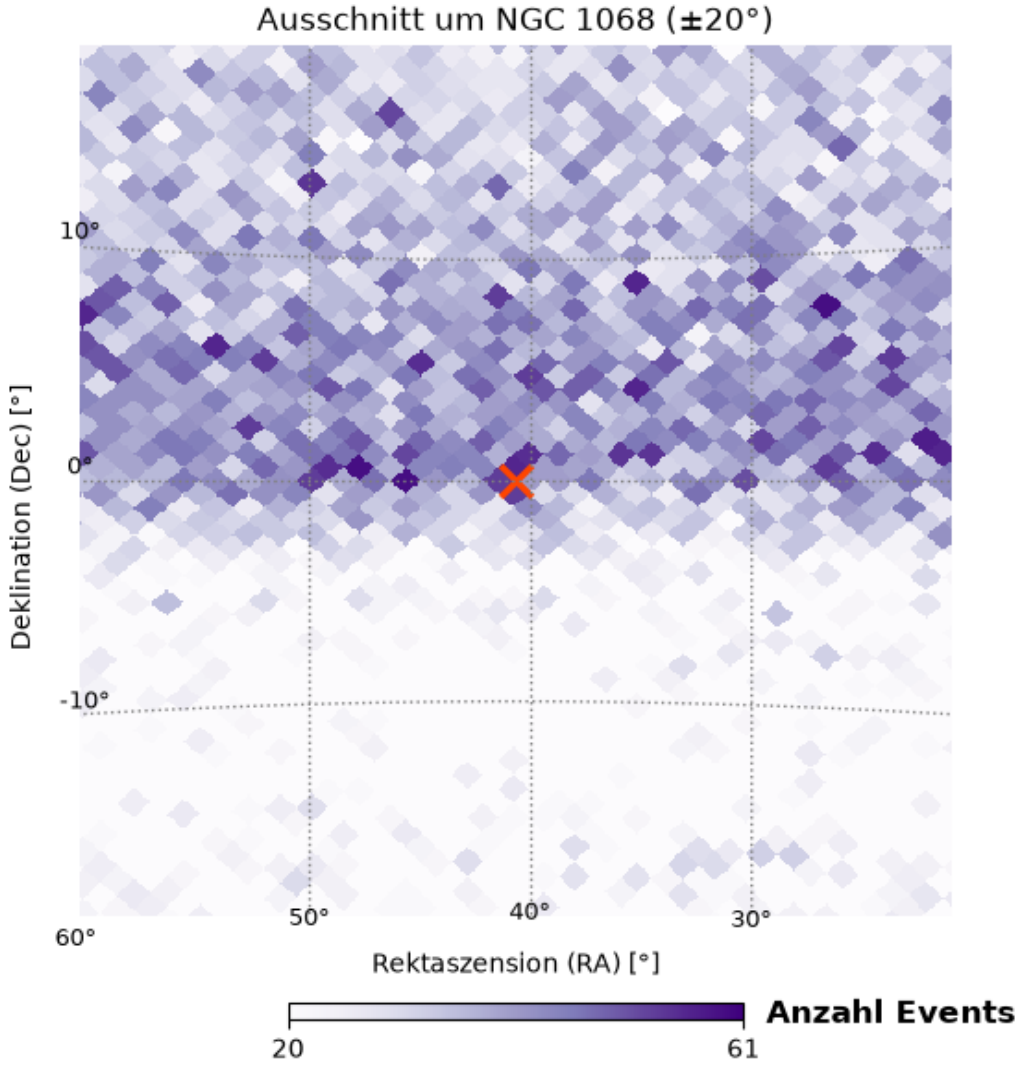
Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Quelle: NASA





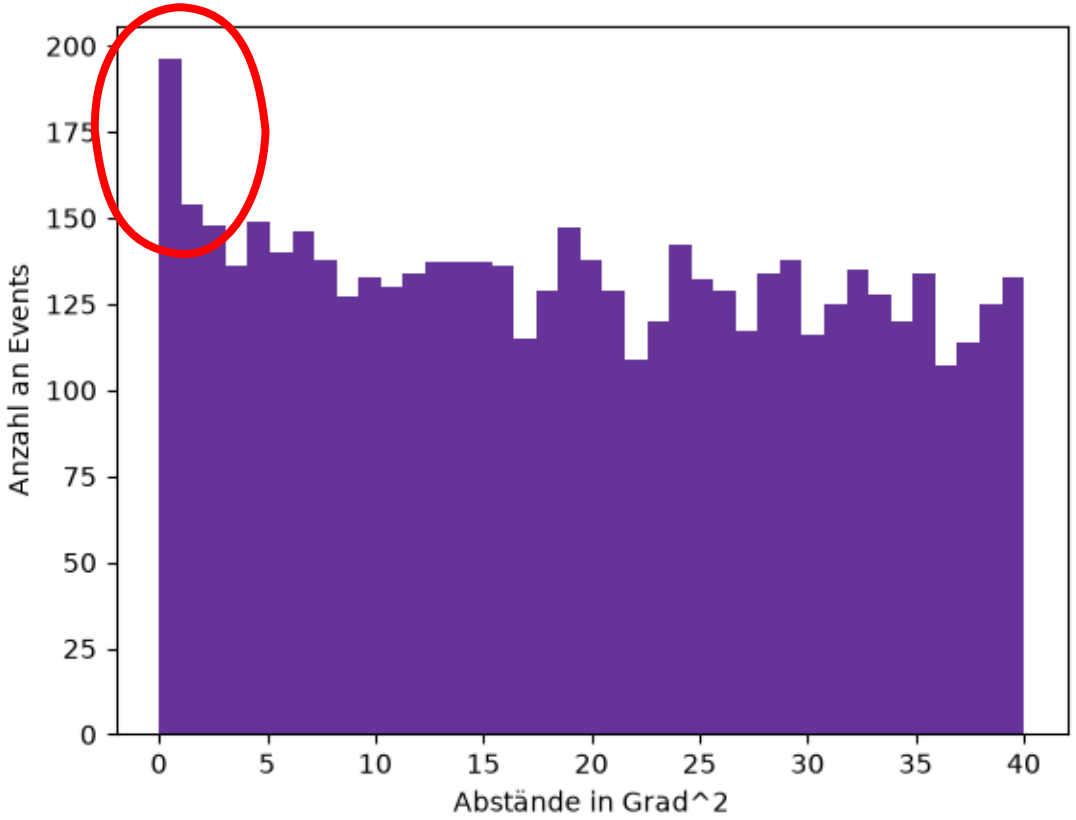
Neutrino Himmelskarte

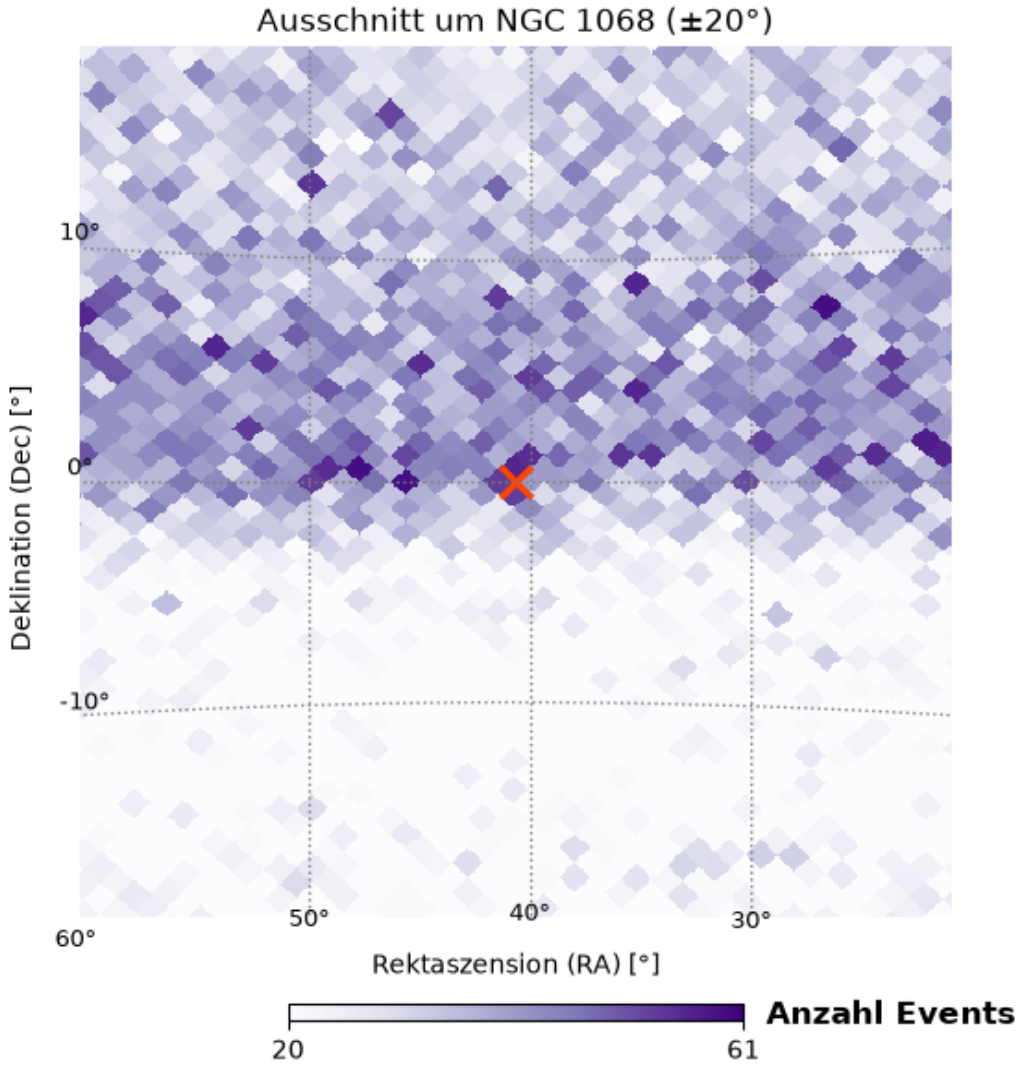
Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Quelle: NASA

Viele Events um unsere aktive Galaxie herum!





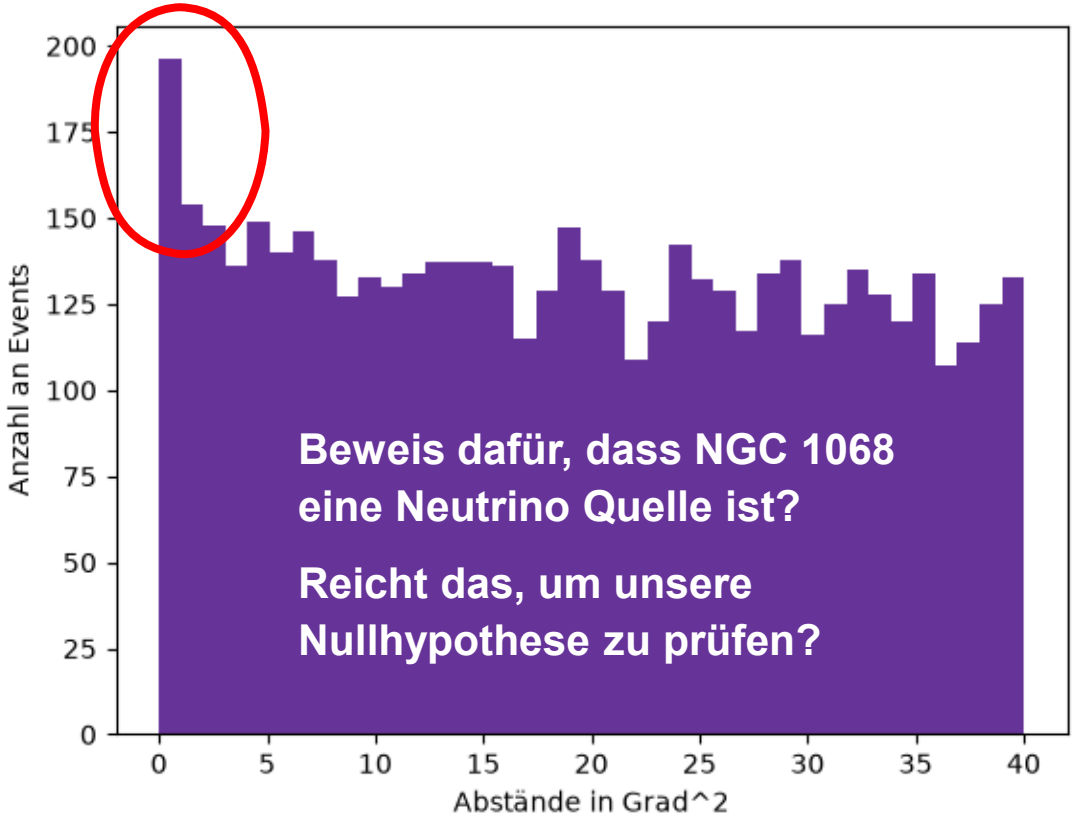
Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



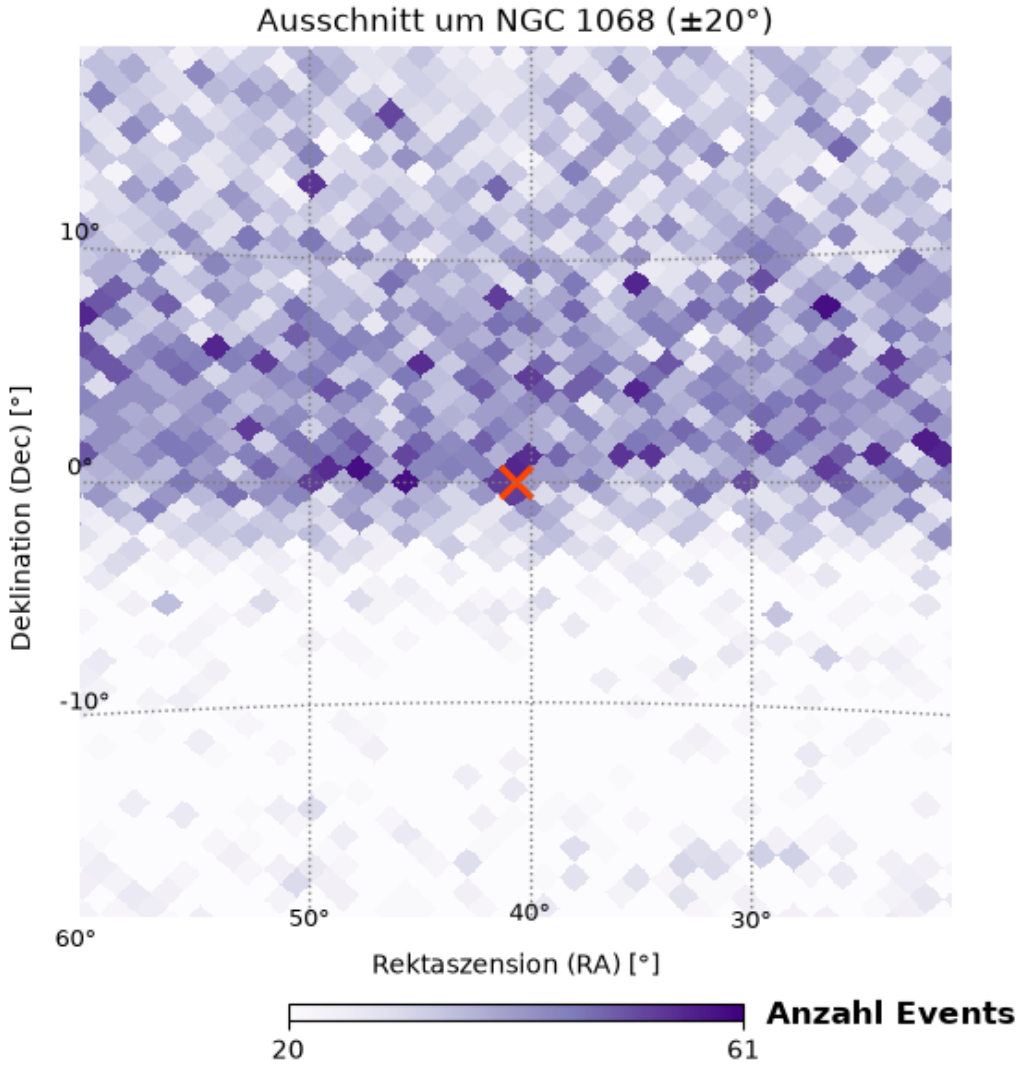
Quelle: NASA

Viele Events um unsere aktive Galaxie herum!



Beweis dafür, dass NGC 1068 eine Neutrino Quelle ist?

Reicht das, um unsere Nullhypothese zu prüfen?



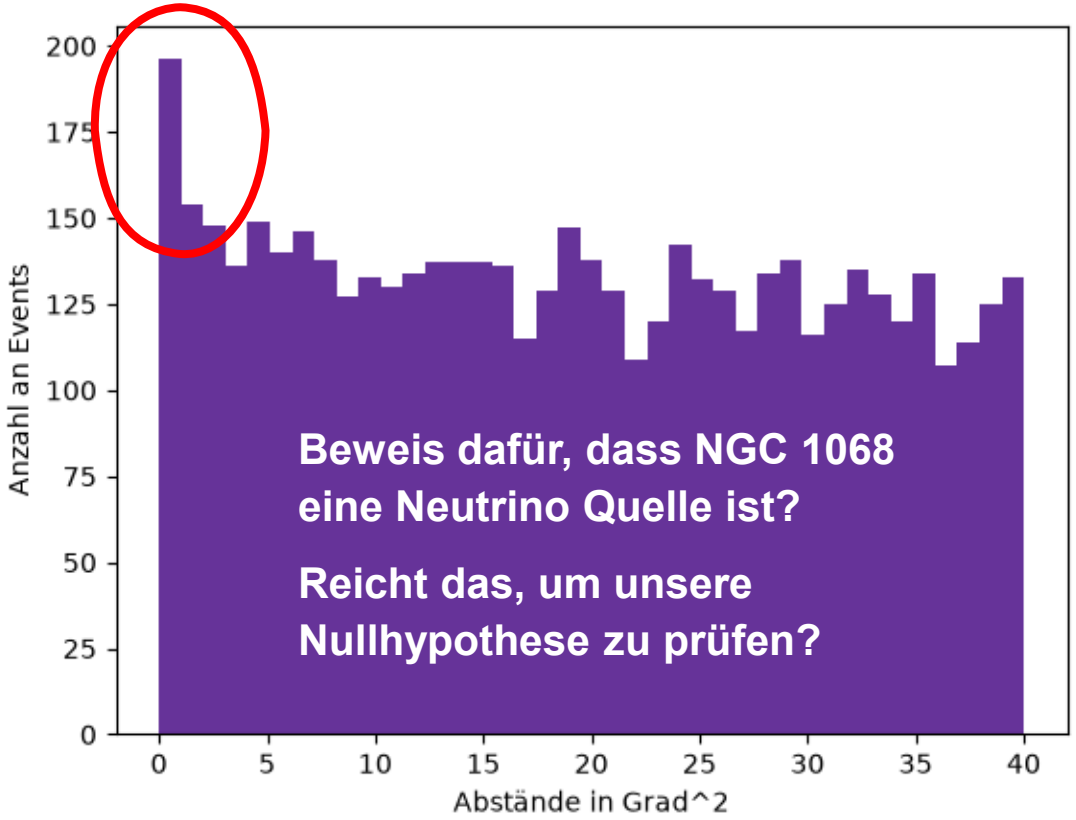
Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



Quelle: NASA

Viele Events um unsere aktive Galaxie herum!



Nein… es könnte ja reiner ZUFALL sein…

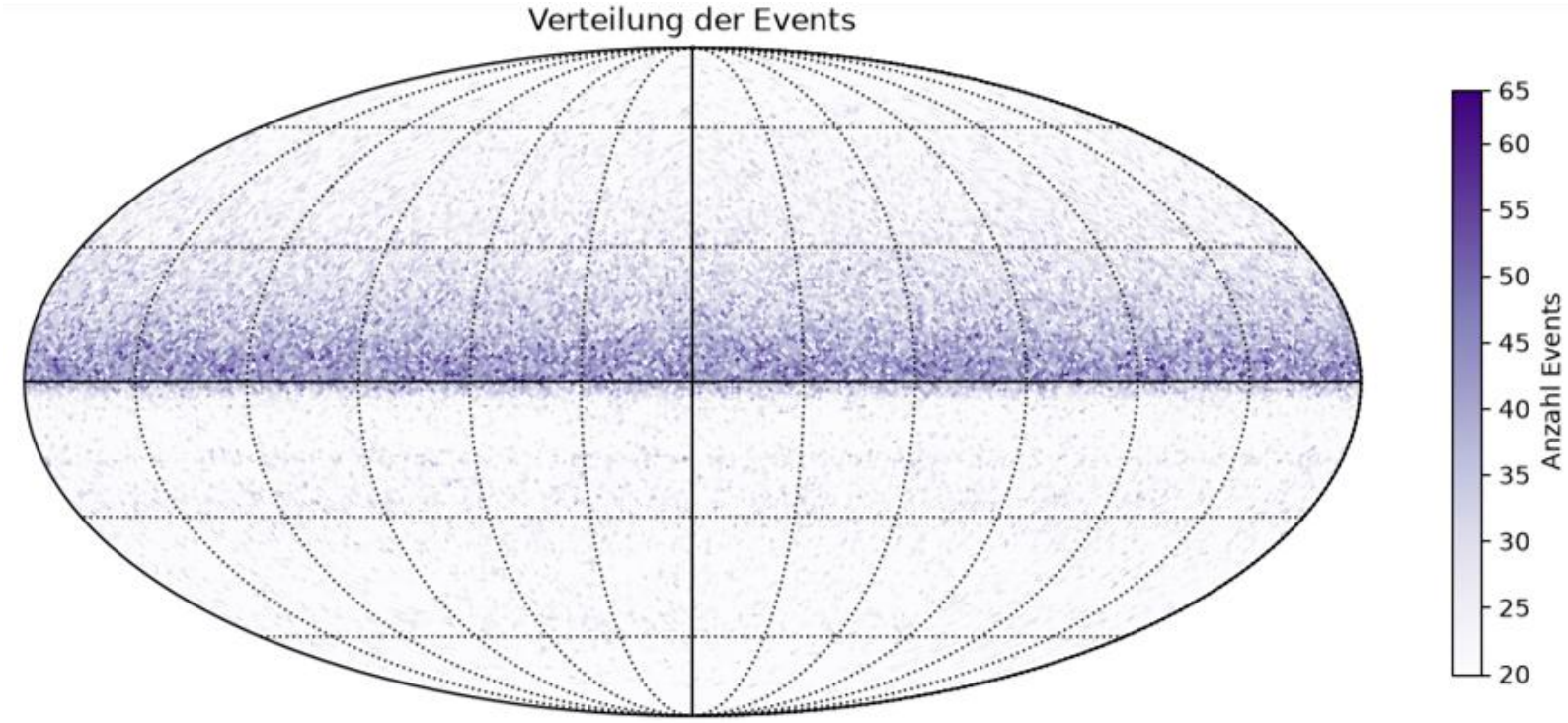


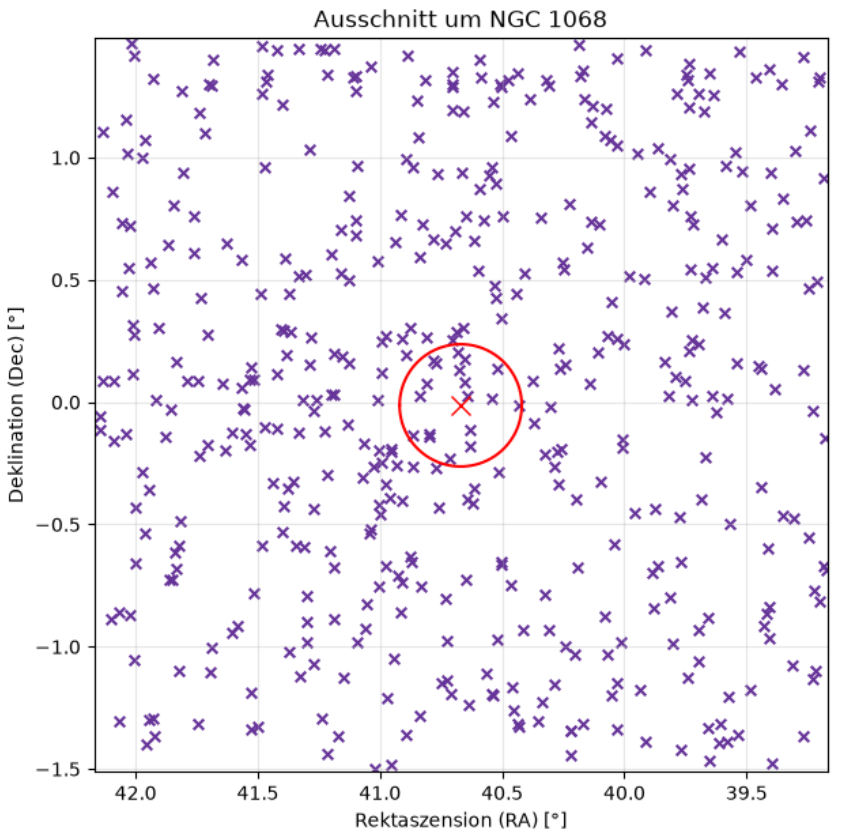
Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



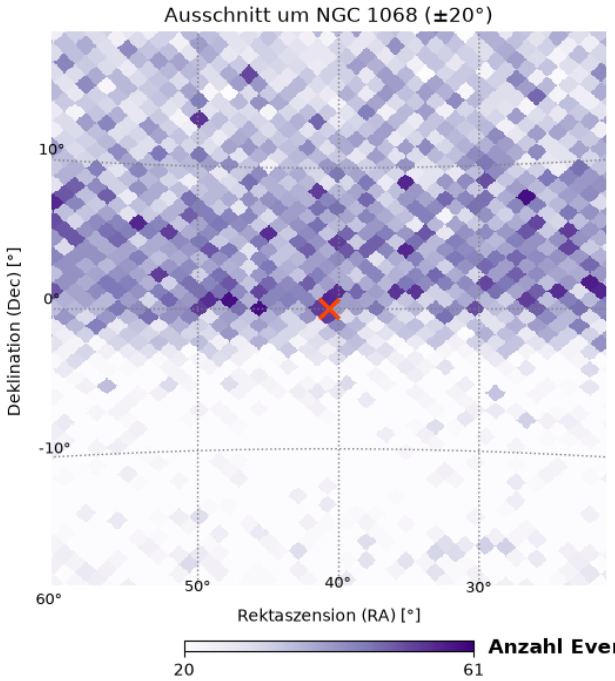
Quelle: NASA





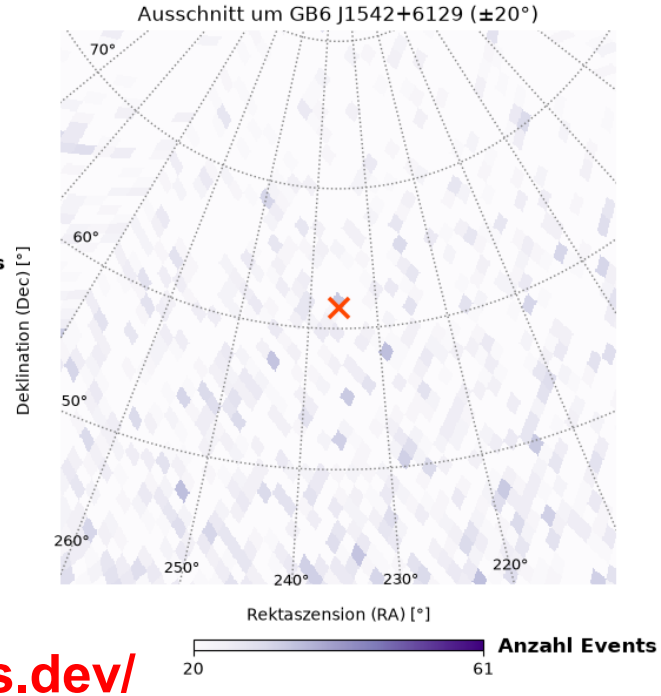
Neutrino Himmelskarte

Events in einer Himmelskarte – erkennen wir einen Zusammenhang?



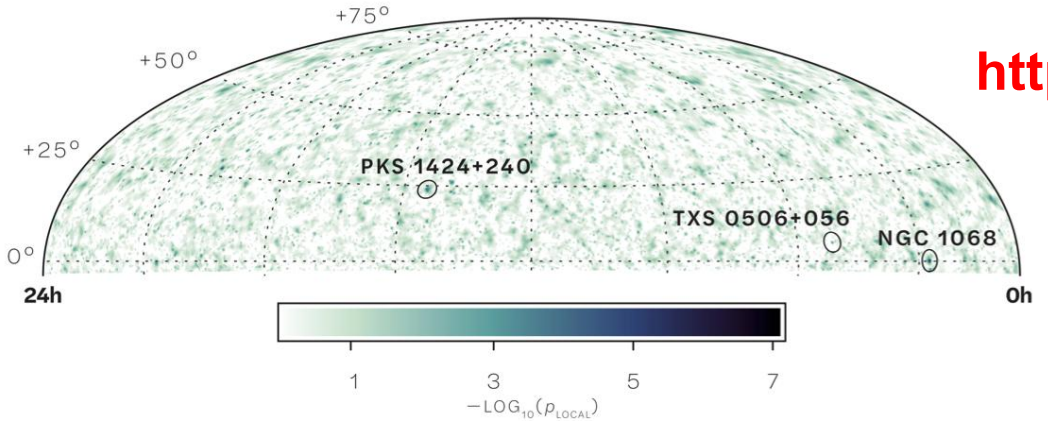
Passwort: ecapmasterclass2026



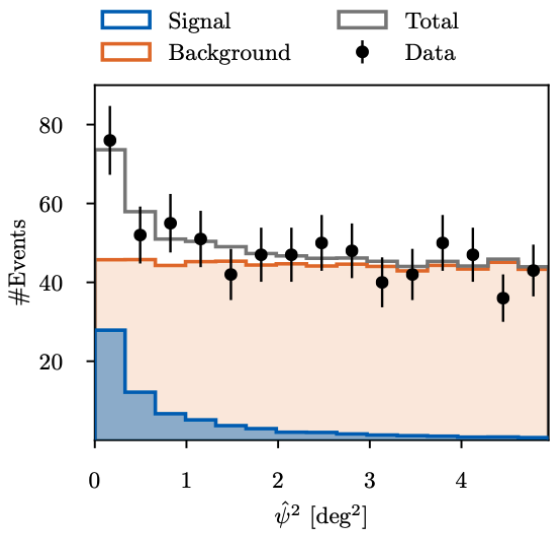


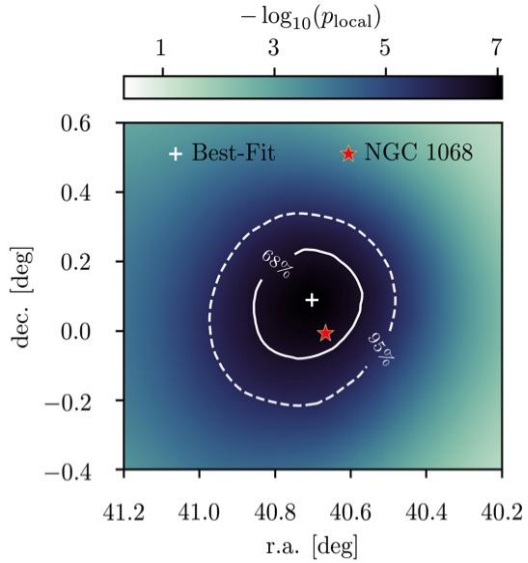
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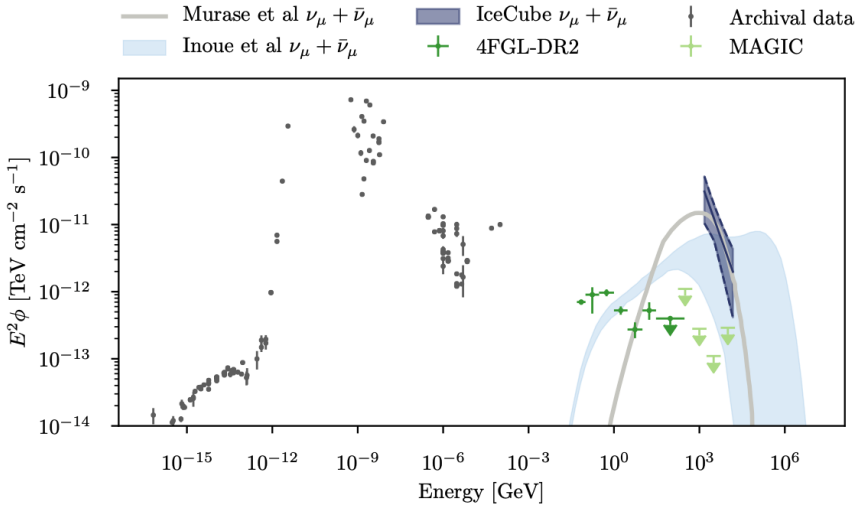
Offizielles Paper



https://arxiv.org/abs/2211.09972

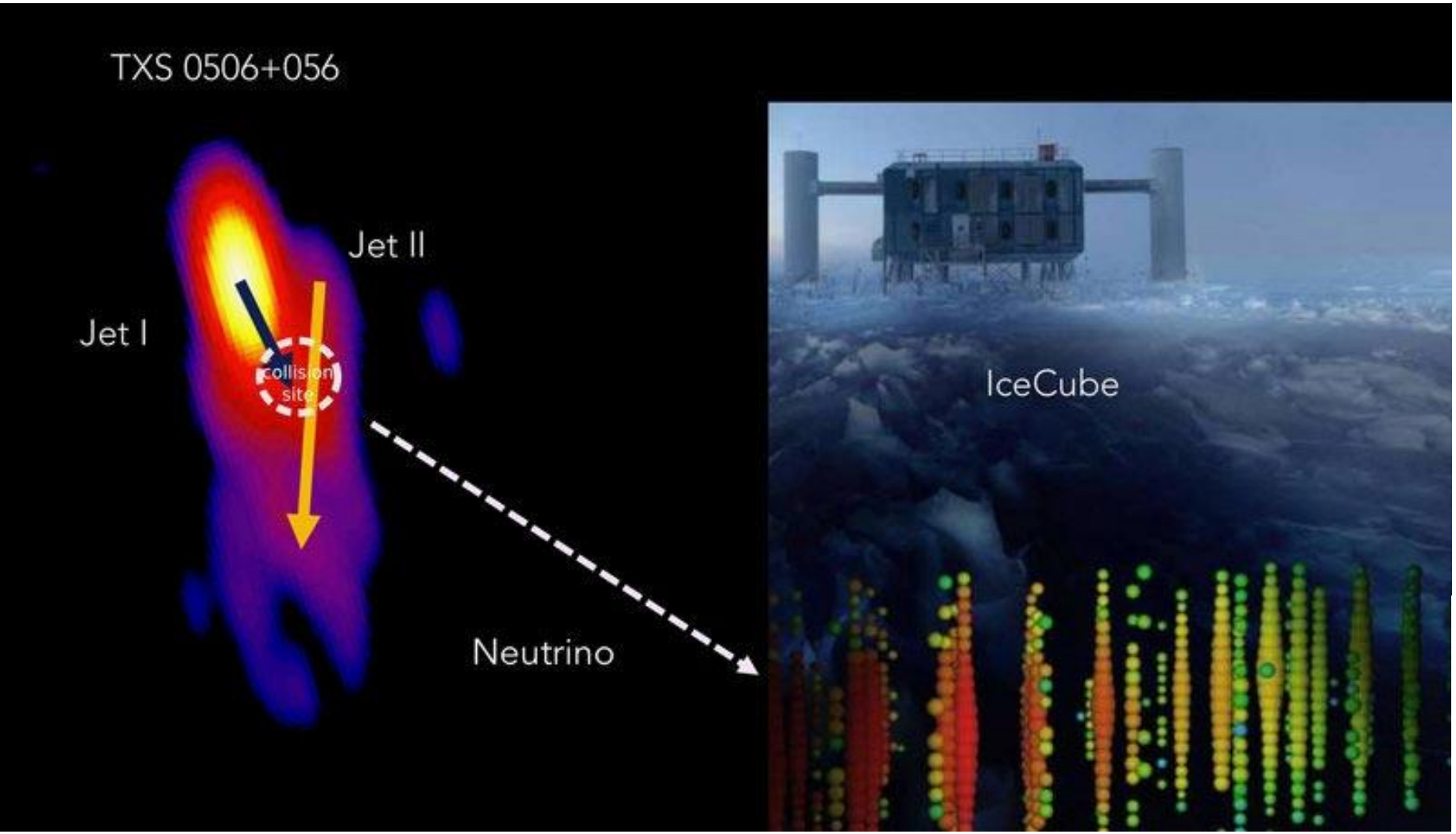


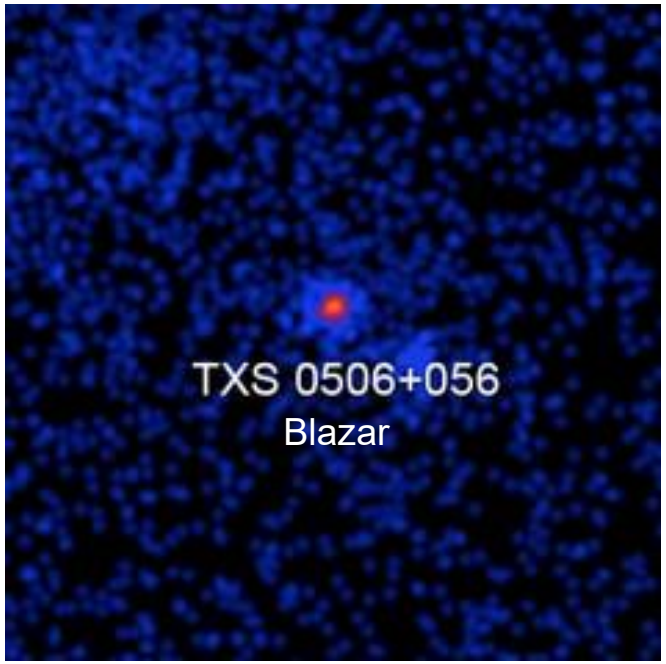




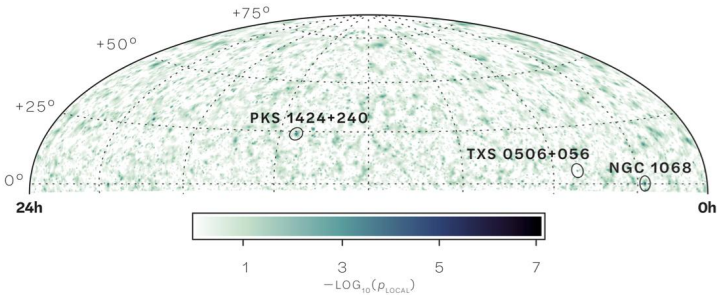
Was haben wir damit gefunden?

TXS 0506+056





Quelle: NASA



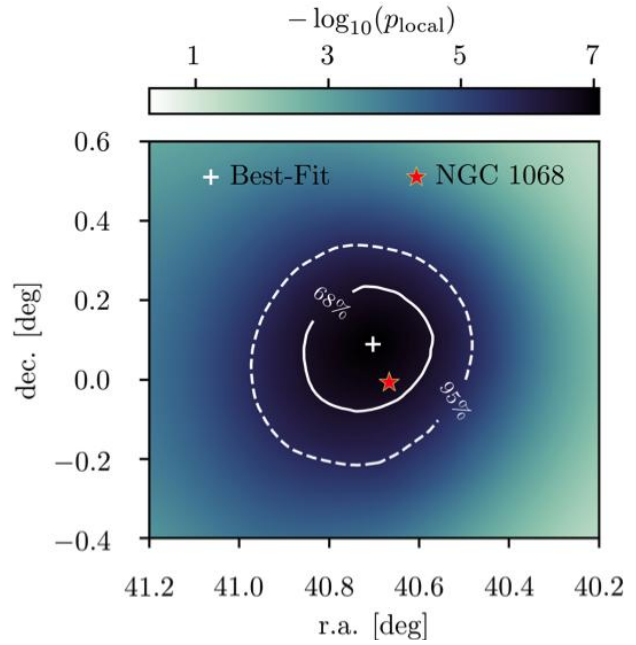
Was haben wir damit gefunden?

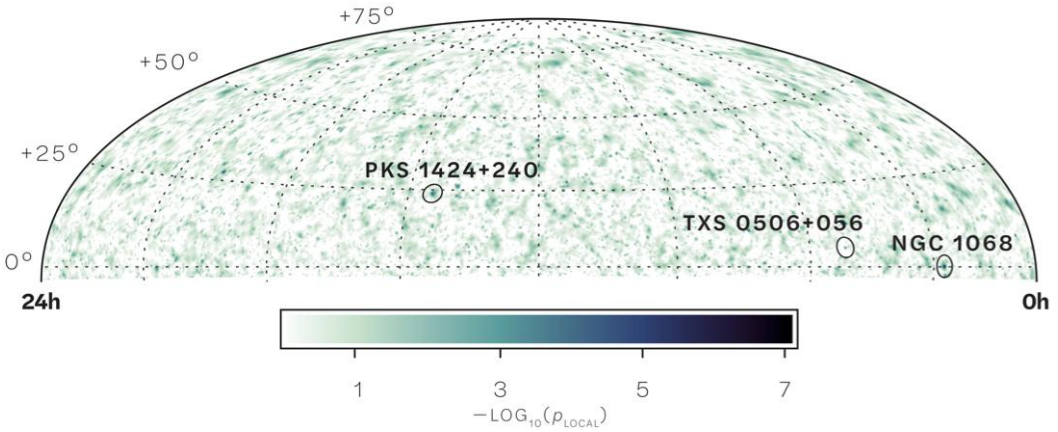
NGC 1068



Quelle: NASA

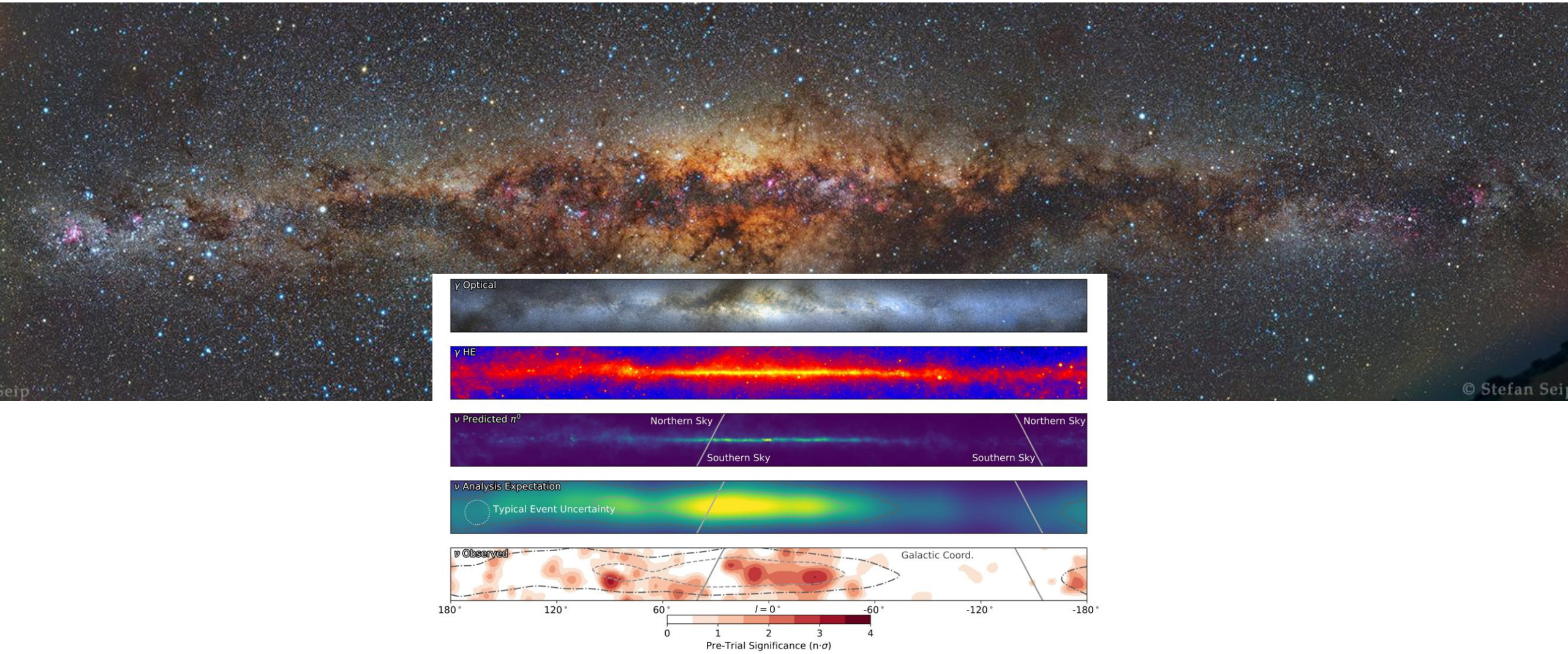






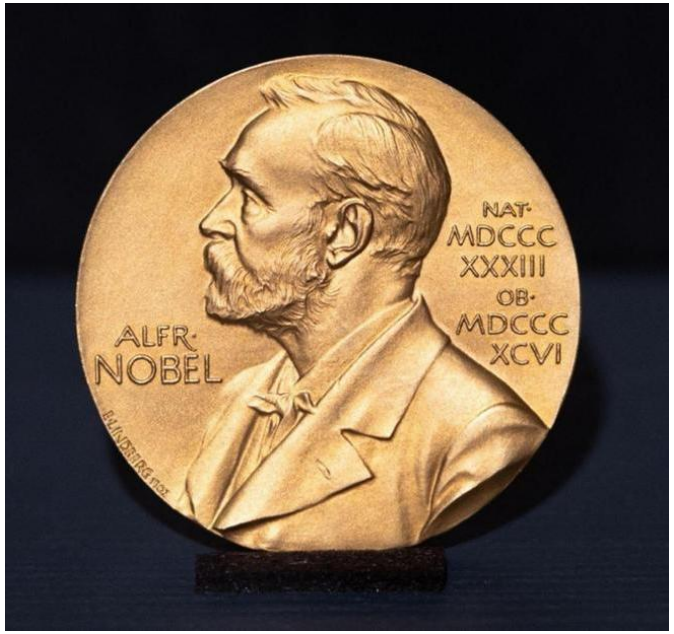
Was haben wir damit gefunden?

Unsere Milchstraße



Nobelpreis 2026

IceCube Neutrino Observatory





Friedrich-Alexander-Universität
Erlangen-Nürnberg





FAU