

# The Way of Saint James: a road of astronomical tradition

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## Abstract:

The Romanesque architecture in the Iberian Peninsula was introduced through the Way of Saint James, as one of the main routes of pilgrimage of the XI century. This building fever would let us verify the ecclesiastical canons on the orientations of the Christian churches, as one of their main characteristics is definitely their eastwards orientation, which ideally would follow the astronomical equinox. This archaeoastronomical research should be completed by an ethnographic study of the astronomical traditions, as well as a research on the light and shadow effects of some of the monuments. This way we could recognize its value under an astronomical approach.

## Context of the research

### What about the East?

- First, that Paradise is in the East, and we pray to return there.
- Second, that the light of day rises in the East, and therefore we pray in that direction to worship Christ, who is the East and the True Light.
- Finally, that the Sun rising in the East represents the rising of Christ, the Sun of Justice.

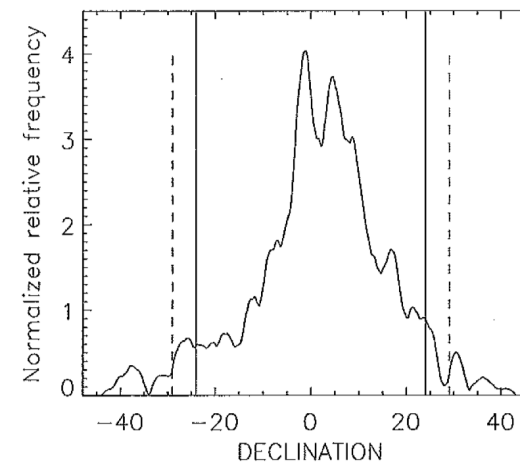
Honorius of Autum, *Gemma animae*  
(McCluskey, 2004)<sup>1</sup>

### Wide variety of interpretations of East!

- Sunrise on the feast of the church's patron saint
- **Equinox:** astronomical, canonical, Roman... (Ruggles 1999; González-García and Belmonte 2006)<sup>2,3</sup>

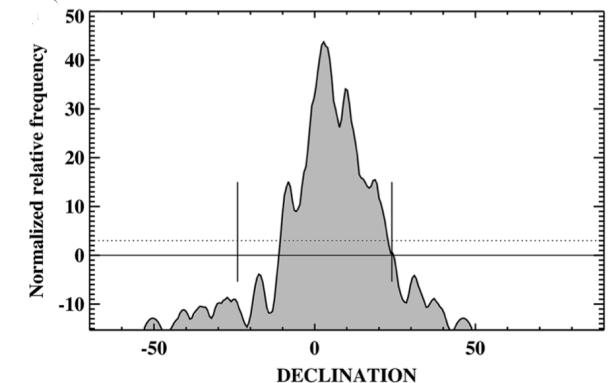
## Preliminary works

A review of the works done in the last decades (González-García 2014)<sup>5</sup> suggests that eastward orientation is followed fairly consistently throughout Europe, but with possible regional variations.



Declination histogram for 425 churches from early Christianity until the Gothic style in Europe (González-García 2014)

A study of the pre-Romanesque churches in the Iberian Peninsula and the Balearic Islands (González-García and Belmonte, 2015)<sup>6</sup> shows an orientation pattern with a clear tendency to face eastward, following the Vernal equinox of 25 of March.



Declination histogram for 167 pre-romanescque churches from Iberian Peninsula (González-García and Belmonte 2015)

[1] McCluskey, S.C. (2004) Astronomy, Time and Churches in the Early Middle Ages. In: *Villard's Legacy: Studies in Medieval technology, Science and Art in Memory of Jean Gimpel, Visa Studies in the History of Medieval Science*, edited by M. T. Zenner, Techonoly and Art 2, 197-210. Alderchot: Ashgate Publishing

[2] Ruggles, C.L.N. (1999) Whose equinox? *Archaeoastronomy* 22: S45-50

[3] González-García, A.C.. Belmonte, J.A. (2006) Which equinox? *Archaeoastronomy. The Journal of Astronomy in Culture* XX: 97-107

[4] González-García, A.C. (2014) A voyage of Christian medieval astronomy: symbolic, ritual and political orientation of churches. In: *Stars and Stones*, eds. F. Pimenta, N. Ribeiro, F. Silva, N. Campion, A. Joaquineto and L. Tirapicos. British Archaeology reports: 240-248

[5] González-García, A.C.. Belmonte, J.A. (2015) The Orientation of Pre-Romanesque Churches in the Iberian Peninsula. *Nexus Netw J* 17, 353-377

# Description of the project

## The Way of Saint James

After the discovery of the tomb of the Apostle Saint James in the IXth Century, the **pilgrimage to Santiago de Compostela** was significantly intensified in the following centuries.

This was the main route of spread of the **Romanesque architecture** in the Iberian Peninsula, specially during the XII and first half of XIIIth centuries.

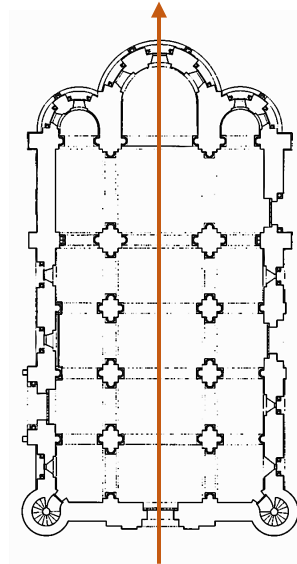


Systematic analysis of the orientation of the Romanesque churches along the **French Way**, the oldest pilgrimage road.

## Archaeoastronomical data

*In situ* measurements:

- Latitude ( $\phi$ )
  - Longitude ( $\lambda$ )
  - Azimuth ( $\alpha$ )
  - Horizon altitude ( $h$ )
- } Declination ( $\delta$ )



Plan of San Martin of Tours of Frómista, adapted from *Enciclopedia del Románico*. The orange arrow indicates the orientation of the church.

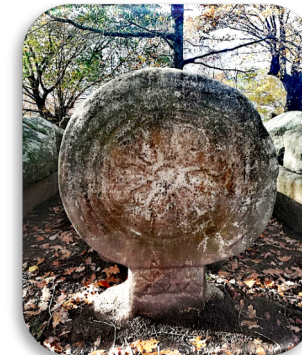
## 3D Modelling

Study the **light and shadow effects** on dates such as the equinoxes and solstices or feasts of patron saints, to see how these relate to popular traditions and the liturgical calendar.

3D model of San Miguel Arcángel of La Laguna.



## Ethnoastronomy

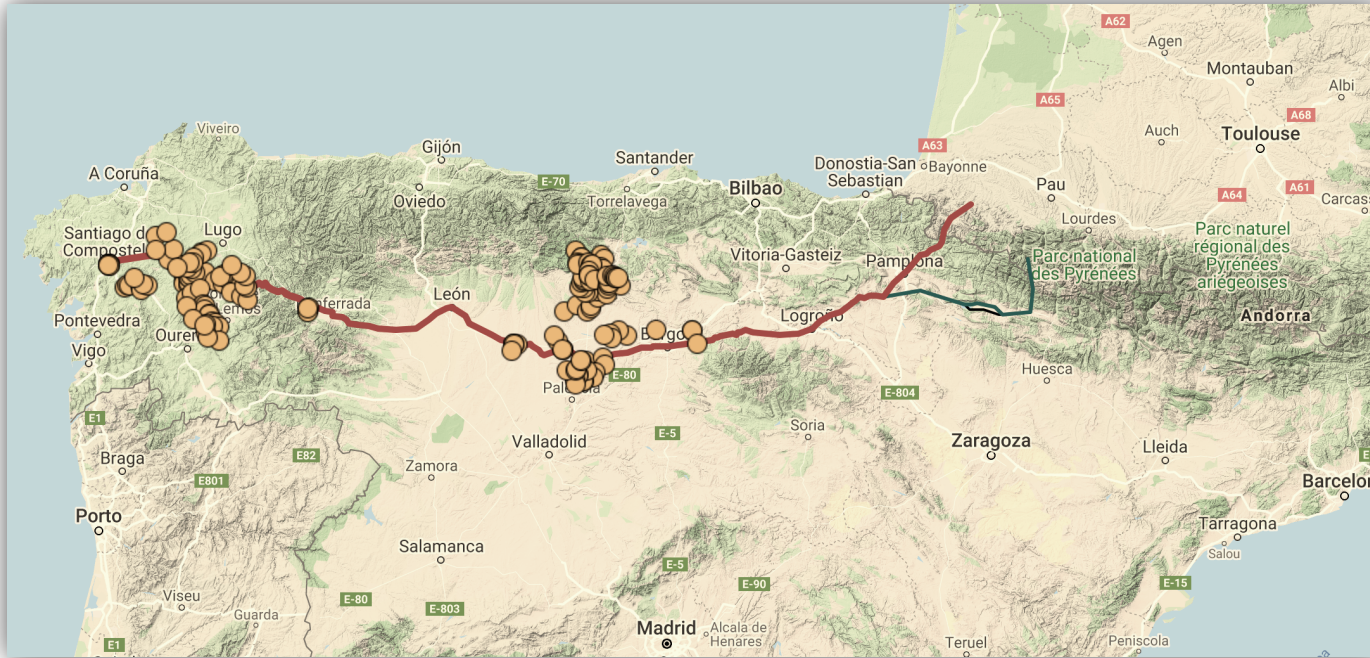


*Hilarria* from Argiñeta necropolis in Elorrio, Bizkaia.

Understand the **astronomical traditions**. For example, the Basque funerary stela, “*hilarriak*”, which should also face East, and are decorated with solar pagan symbols or christograms, among others.



## Results I - Data sample



Map of the measured Romanesque churches along the French Way, marked in red.

### Campaigns

On 2019, two areas:

- **Galicia** : The French Way (57) + Ribeira Sacra (28) → 85 churches
- **Castilla y León**: The French Way (46) + The Mountain (55) → 101 churches

## Selection criteria

The building must have distinctive elements from the Romanesque style, as the semicircular arcs or apses.



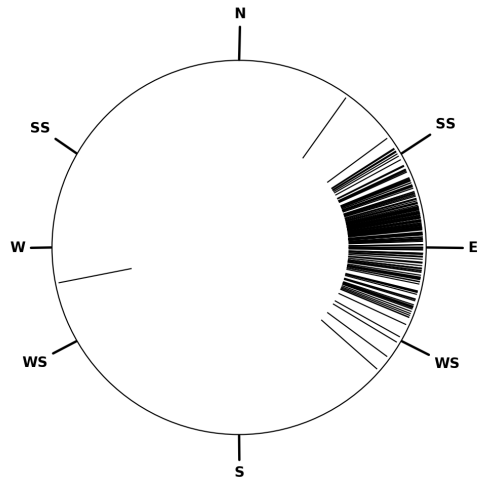
(Top) Santo Estevo of Ribas do Miño, in Ribeira Sacra (Galicia), built in XII century.  
(Bottom) San Martin of Tours of Frómista (Castilla y León), built in XI century.



## Results II – Global statistics: preliminary results

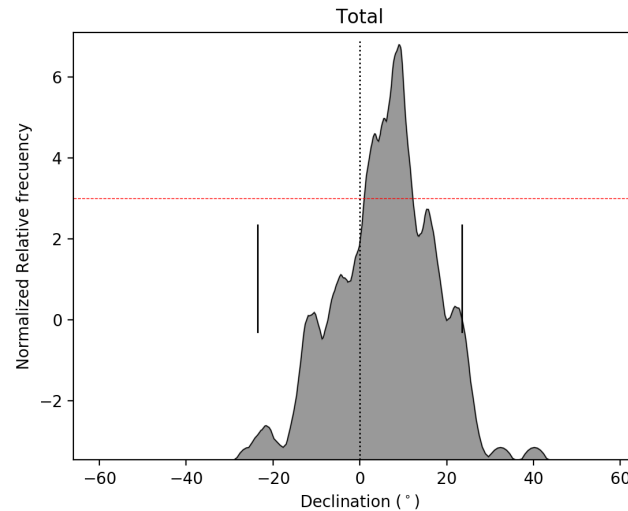
- Azimuth measurements were corrected from magnetic declination<sup>1</sup> and the horizon altitude from atmospheric refraction<sup>2</sup>.
- Histograms were built using a Kernel Density Estimation with a bandwidth of twice our estimated error (for declination  $\sim 0.75^\circ$ )

Azimuth



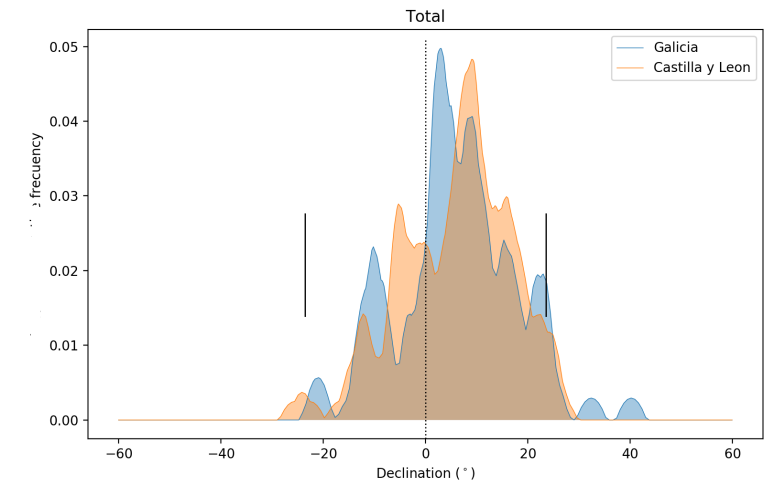
Orientation diagram for all churches in our sample (186). **Almost all the measurements fall within the solar range at sunrise**, indicated by the Summer Solstice (SS) and Winter Solstice (WS) marks.

General declination



Declination histogram for all churches in our sample. Vertical solid lines indicate the solstices, while the central dashed line stands for the astronomical equinox. The red horizontal dotted line indicates the orientations that could be considered significant (above  $3\sigma$ ). **Notice the principal maximum, shifted to the North of the East.**

Regional declination



Declination histogram for our sample, separated into the regions of Galicia (blue) and Castilla y León (orange). Although there is a clear tendency towards the East, there are some variations between both regions, leading to different possible interpretations.

[1] Magnetic declination from [www.ngdc.noaa.gov](http://www.ngdc.noaa.gov) site using the WMM model and the Spanish IGN site <https://www.ign.es/web/ign/portal/gmt-declinacion-magnetica>

[2] Schaefer, B. (1993) Astronomy and the Limits of Vision. *Vistas in Astronomy*, 36: 311-361.

## Impact and prospects for the future



Astral decorations in a door of the church of Santa Cruz of Retorta, in Galicia.

Popular statement that “all churches must face East” seems to be a **simplistic view**. The reality is much more complicated, reflecting the political and cultural circumstances of the epoch and of the particular regions, which impact on the chosen orientation of their monuments.

### Future work

- Archaeoastronomical data:
  - Complete the sample with the Romanesque churches of the other sections of the French Way: Navarra, Aragón and La Rioja.
  - Regional analysis of the data, to stand out the possible similarities and differences between them (and **why!!**).
- **3D Modelling** of at least two striking churches, such as Saint Mary of Eunete (Navarra).
- **Ethnoastronomy**: Taking advantage of the campaign in Navarra, carry out the research on the *hilarriak*, very numerous in this region and its surroundings.