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# LIGHT BEAMS AND ARCHITECTURE MARKED CELESTIAL EVENTS IN COLONIAL CHURCHES AND MISSIONS IN NEW SPAIN AND PERÚ: NEW EVIDENCE FROM MORELIA

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**ABSTRACT**

The lights that I report here exist because windows were designed by architects to project light into aisles and impact other objects of interest on days of ecclesiastical interest in American Colonial Churches. Surprisingly, since such phenomena are widely known in the Europe (see examples in this issue), they have not been reported as European architectural designs in the Americas previously except for the work of Ruben Mendoza in the missions of California (2005) and my work in Latin America (2013).

I have previously described missions and churches from in and around San Cristóbal de las Casas, México, Lima, Perú, and San Antonio, Texas, and here I report additional cases from another Colonial town, Morelia, Michoacán, México.

Lights discovered by Mendoza in Franciscan missions from the northern frontier of New Spain, now California, were associated with both eschatological architecture as well as ecclesiastical iconography (2005).

I briefly review equinoctial, solsticial, and cross-quarter alignments of four previously described Colonial churches from San Cristóbal de las Casas, Chiapas, México. New data are presented for two additional Colonial churches from Morelia, Michoacán, México. These new data make clear that the phenomena from Chiapas are not unique to that state although the tracing of the Meridian line by a beam of light from the dome down the aisle was found only in Chiapas and in Lima, Perú.

**KEYWORDS:** Colonial churches, astronomical alignments, light beams, México, Perú

## 1. INTRODUCTION

Architects designed church windows and entryways to illuminate special interior targets for astronomical and ecclesiastical dates in Europe. Surprisingly, until recently, knowledge had been lost of similar alignments in the Americas (Mendoza 2005, 2009; Benfer 2013). A few examples of churches built upon indigenous monuments having astronomical orientations are known. San Cristóbal (2000) described solstice lights entering the church of San Francisco, Quito, Ecuador (0°13'12'91" S, 78°30'55. 33" W). He observed the sunrise light illuminating the towers of the church and the altar with a brilliant light. This church was built over an Inca temple. Google Earth confirms a June solstice alignment with the volcano Cambaye. On the 21 of December 1534, with 2.3° elevation, the azimuth of the solstice is 66°44'. The azimuth from Google Earth is 65°52'. The azimuth could vary with the point selected as the peak. Of course, the height of the window and distance from the altar would effect the azimuth observed, but I do not know these. However, the suggested alignment with another volcano, Antisana, is not plausible, if the peak observed from the church is accurately located by Google Earth, which may not be the case. The orientation of the nave of the church is approximately 120°, which is the lunar standstill, that although not a Christian orientation was one very important in Andean cosmology and presumably linked to the underlying Inca temple.

Churches in Mesoamerican were also built on indigenous footings. The largest archaeological site of a pyramid in the Americas is Cholula, Puebla, México (19°03'27"N 98°18'07"W). The view looking from the top across the entry stairs of the pyramid has an azimuth of 296° with an elevation of 1° measured from Google Earth Pro. However, the church on top of the pyramid was set at 287°, a substantial departure from the solstice sunrise.

In the Middle East, Schibille (2009) notes that early Christian sources recommended churches be oriented to the East. Hagia Sophia (41° 0'30.44"N 28°58'47.97"E), one of the earliest churches whose footings are intact, was first constructed in the fourth century AD (Schibille 2009: 31). Schibille argues that the deviation of several degrees from the true equinox could be due to architects having used Ptolemaic latitudes and ancient formulae rather than observed sunrise to establish the orientation. On the other hand, she notes that it could be oriented to the shortest day in the year. Neither explanation is plausible for Cholula.

Another Colonial church built on a prehistoric structure is SantoTomás in Chichicastenango, Guatemala (14°56'31.24"N 91° 6'40.92"W). Its orientation from Google Earth is approximately 295°. The feast of Saint Thomas takes place on December 21.

Orientations of other churches and missions are discussed elsewhere (Benfer 2013). Now I turn to the discussion of light phenomena in several Latin American churches designed by Spanish architects. Although windows are used everywhere to illuminate special architectural features in churches, windows in domes provide the most dramatic light shows, projecting beams of light down through the nave and chapel and sometimes to entryways. However, windows in walls too can be placed for dramatic affect. In California, then part of New Spain, missions lacking domes used windows, which illuminated points of ecclesiastical interest in beautiful displays of light (Mendoza 2005:2-5). The lights discovered by Mendoza in Franciscan missions from this northern frontier of New Spain were associated with both eschatological architecture and ecclesiastical iconography (2005). In addition, Mendoza argues that the syncretic adoption of Cristo-Helios was still present in the late 18th and early 19th century missions built by Franciscan and Ohlone Casanoan Indians in California.

Here I briefly review some of the alignments documented in two well-studied Colonial churches in Chiapas, México (2013). Following this discussion, I will turn to new findings from two Colonial churches in Morelia, México.

## 2. CHIAPAS

The first study of these lights took place in 2007 and continued through 2015. The planetarium program Starry Night Pro was used to determine rises and sets of the sun at the time when the churches were being constructed. Google Earth Pro provides images and azimuths of churches augmented by Brunton compass, mounted on a camera tripod.

Santo Domingo, la Caridad, and two later churches, Santa Lucia and Guadalupe, are located in San Cristóbal de Las Casas, Chiapas, Mexico (SCLS hereafter). These churches and others in Chiapas have been described in detail by the architect Markman (1984), who did not notice the astronomical phenomena discussed here.

All dates of construction for these churches are taken from Markman unless indicated to the contrary. It has to be noted that Markman's drawings are not always accurate with respect to magnetic north, although his alignments of churches in San Cristóbal de las Casas (SCLC) are about right. My measurements with declination-corrected Brunton compass confirm that all but one are oriented to the equinox.

La Caridad (16º44'27.13"N 92º38'13.57"W) is a Dominican church in SCLC, whose first construction dates from around the second decade of the 18th century.

On September 22, 2007, the vernal equinox, light from the southwestern of the four windows in the dome over the chapel of La Caridad, cast a beam of light that moved up the center aisle of the church to stop at the altar. In this church, the altar is beneath the principle dome.

Just to the west of La Caridad, one finds the much larger church of Santo Domingo (16º44'29.65"N 92º98'14.37"W).

Initial construction at Santo Domingo was probably around 1560 AD, although it was not the first church in SCLC. That is San Nicolás, a church that faces south, which is unusual. The most detailed descriptions of Santo Domingo are by Remescal (1932) and Aubry 1991).

A bright beam of light appears from a window in the southwest of the dome of Santo Domingo on the equinox. It travels to the pulpit where it dies. The pulpit is in front of the principle dome. The line barely stays within the aisle on the equinox and is more deviant than the one in la Caridad and other SCLC churches. The center of the present aisle measures equidistant from each wall. Since the light beam reached very close to the pulpit, it might have been judged acceptable. A brief video is available taken on Psalm Sunday, March 16, 2008, four days before the equinox. The light beam passed along the north side of the aisle. (http://www.youtube.com/watch?v=xjsvAzOs8LM&feature=mfu_in_order&list=UL)

A solstice orientation, in which a beam of light illuminates the northern entryway of Santo Domingo, appears off a few degrees, which could be due to the thick molding placed around the door, an adornment the church architects might not have anticipated (Benfer 2013). Two other Colonial churches, Santa Lucia and Guadalupe in SCLC also show Meridian lines, but they are discussed elsewhere (Benfer 2013). The north entryway to la Caridad is fully illuminated by the December solstice sun.

Recently, another light beam was seen to strike a cherub on the top of the retablo at the church of La Caridad on the February 4, 2015 cross-quarter day, thus marking the day with a light show nearly as beautiful as the one on the cross-quarter day at the adjacent Colonial church of Santo Domingo. There, a beam of light strikes a gold leaf covered wood spindle on the pulpit (Benfer 2013). Whether these light beams were intentionally designed or not, they would have produced awe in indigenous parishioners for whom the February cross-quarter day is still the day of preparation and planting of crops (Furbee 2016).

## 3. MORELIA

Investigation of Colonial churches in Morelia on and around the equinox of March 2015 found no indication of tracing of Meridian lines in the aisles. However, two churches did show astronomical lights.

The Cathedral (19º42'8.15"N 101º11'32.63"W), like the Cathedral in México City, opens to the north. Lights high in the walls of the nave illuminated the stations of the cross, a pattern known from the California missions. Figure 1 shows the morning light beam but not at a time when the stations would have been illuminated. Because I was investigating eight churches in a km radius, it was not possible to be at the right place in each church at the right time. Although I visited the churches the day before the equinox, the elevations of the windows were not measurable accurately enough by Brunton compass to allow me to estimate precise times for the light beams orientation. Figure 2 shows the morning beam striking the west wall below the stations. Figure 3 shows the evening illumination of the east wall stations before losing the daylight to clouds.

The Temple of La Merced in Morelia (19º42'10.10"N 101º11'49.44"W) opens to the east. A beam of light from the dome would illuminate the altar on the equinox. Figure 4 was taken shortly after it had passed over the center of the altar. This illumination is similar to one seen in La Caridad in SCLC and the Chapel of Vera Cruz in Lima, Perú. The Peruvian churches are not oriented to the cardinal or equinoctial directions (Benfer 2013).

*Figure 1, Morning light beam, Morelia Cathedral*

*Figure 2 Morning light beam below stations of cross, Morelia cathedral*

*Figure 3 Evening light beam striking stations of cross, Morelia cathedral*

This brief investigation of equinoctial illuminations shows that there is a least one more colonial American city, Morelia, some of whose churches show astronomical orientations of light beams. Unexpectedly, colonial churches in Morelia open to each of the cardinal directions while only one of the SCLC churches opened to other than the west.

In previous investigation (Benfer 2013), I found that all the missions in San Antonio, Texas were oriented to the west save one, which was oriented to the solstice. In Chiapas, the city churches were primarily oriented to the equinox. Rural missions were more often oriented to the solstice. In Lima, colonial churches do not have an obvious astronomical orientation. They may be oriented with the Rímac river channel, although it frequently changes course.

In all these cases, the architects from Spain designed churches that displayed dramatic beams of light on days of ecclesiastical interest. With differing orientations of naves and differing heights of dome and side windows, these architects designed churches that present these special light shows.

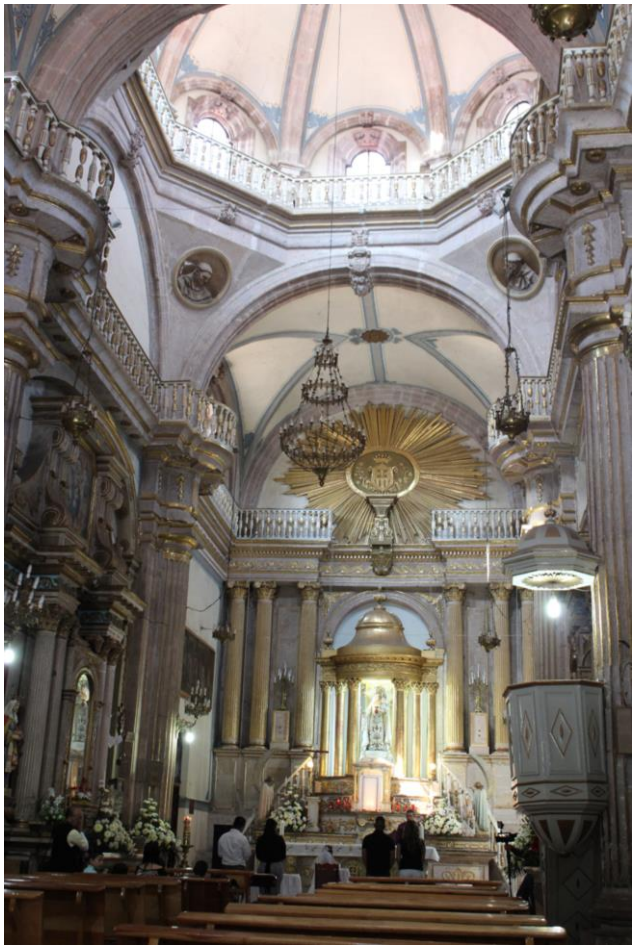

*Figure 4 Light from dome striking altar, la Mercéd, Morelia*

Today, only the curators of the churches and a few archaeoastronomers, such as readers of this and Mendoza's articles, recognize them. Even priests with whom I have spoken see them as nuisances that annoy the parishioners. I have found no examples in churches built after the end of the Colonial Period. The work in Morelia was brief and only a few orientations were documented. Whether more would be seen with further work remains for future investigation.

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