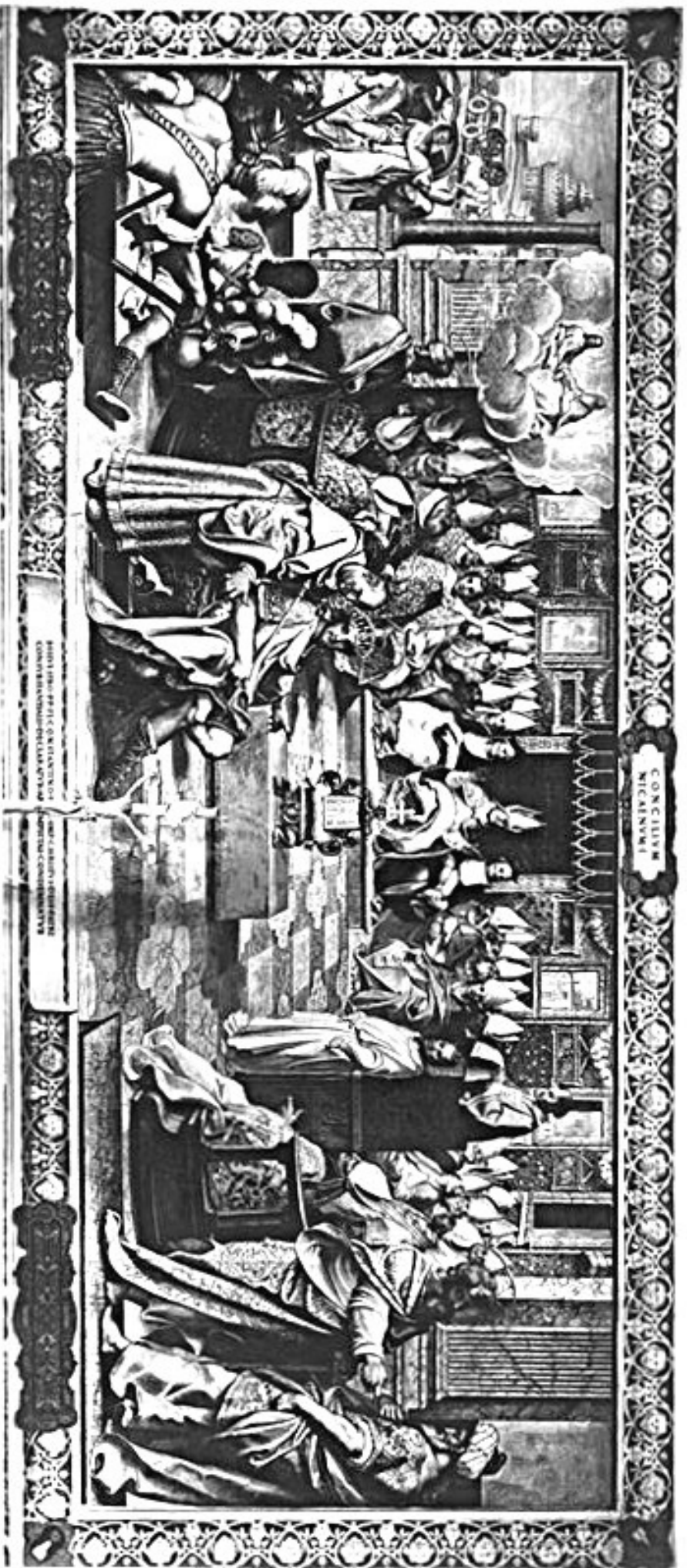


# CALENDAR CONSTRUCTION AND THE PROBLEM OF EASTER



## CHRISTMAS

- Why do we celebrate the incarnation (Jesus' birth) on December 25?
- Winter solstice fell on Dec. 25 , according to the Julian calendar (introduced in 45 B.C.)
- According to the Venerable Bede, the Church fathers chose the winter solstice (the darkest day of the year) to celebrate the incarnation (when light came into the world)
- Nowadays, the winter solstice falls on Dec. 21, according to the Gregorian calendar (introduced in 1584 A.D.)



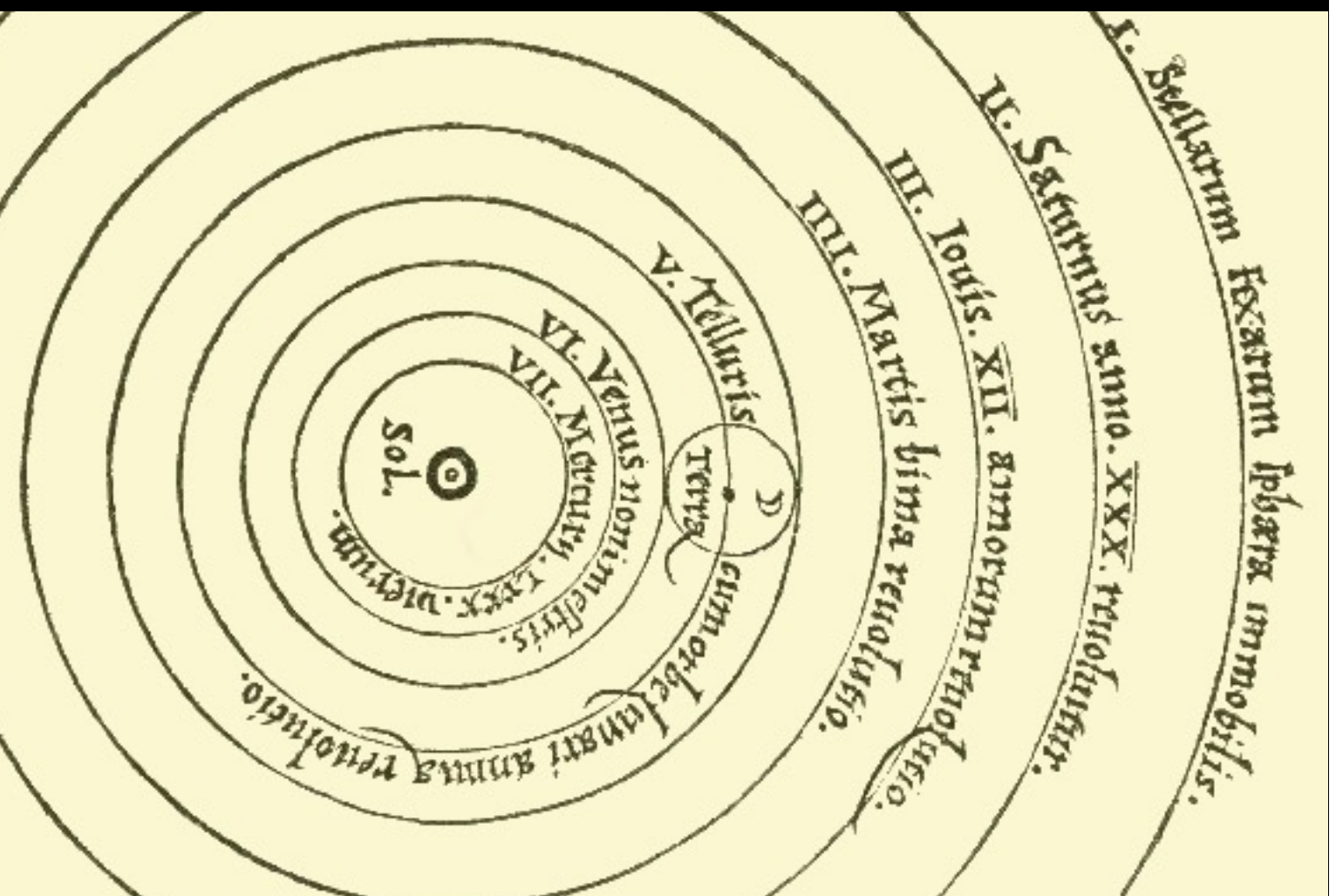
## THE VENERABLE BEDE

- Born 673 A.D.; lived and worked in a monastery in a tiny island off the coast of Scotland
- Wrote a famous *Ecclesiastical History*, poetry, liturgical works, books on grammar, and a book on the use of astronomy in constructing an accurate calendar.
- *On the Reckoning of Time* (723 A.D.)
  - popularized use of *Anno Domini* in dating (introduced by Dionysius),
  - explained allegorical meaning of dates chosen for Christmas (winter solstice), Annunciation (vernal equinox), birth of John the Baptist (summer solstice) and conception of John the Baptist (autumnal equinox)
- dealt with the problem of Easter



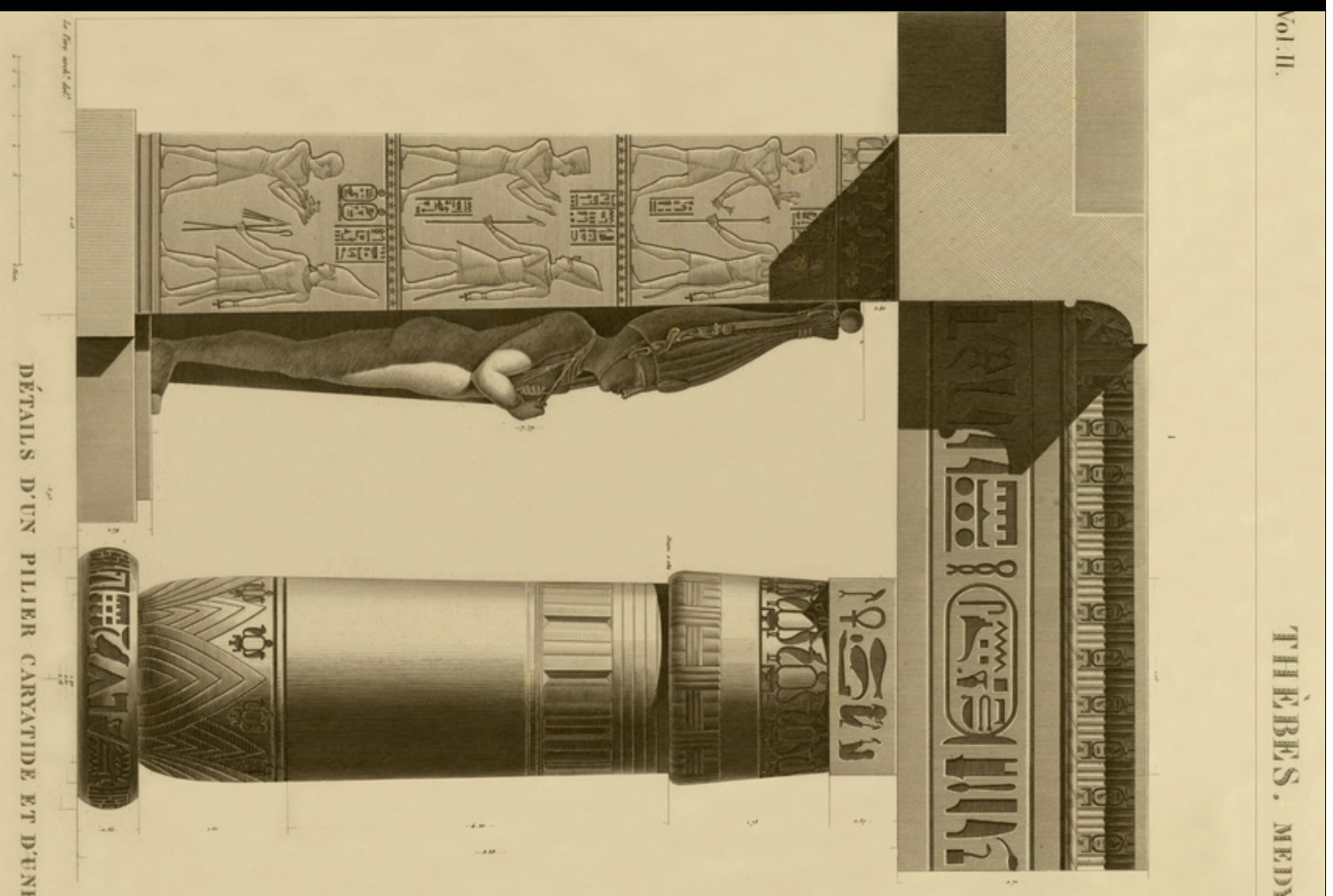
## CONSTRUCTING A CALENDAR

- 1 Year = 365.2422 days (tropical year; from time between equinoxes)
- 1 Month = 27.32166 days (lunar sidereal month; measured with respect to stars)
- 1 Month = 29.53059 days (lunar synodic month; based on phases of moon)
- Can construct a calendar based on cycles of sun or moon (or both).
- Could make year 365 days; must add 1 day every 4 years; then 4th year is too long by about 45 minutes



## ANCIENT EGYPTIAN CALENDAR

- Luni-solar calendar: organized around lunar cycle, but occasionally corrected by sun's position in zodiac in order to prevent drift of growing/flooding season through year
- Lunar: 1 month = 30 days; 1 year = 12 months (360 days in the most ancient Egyptian texts)
- Solar: First month placed near autumnal equinox, when Sirius (dog-star) becomes visible rising in East before the sun
- Interesting: late Egyptian texts inserted 5 days at the end.
- Also interesting: the Vedas (ancient Indian texts) have a 360 day year and do not mention inter-calary days; Sumerian calendars of the 4th millennium use 360 day year; ancient Aztec calendars use 360 day year. Coincidence?





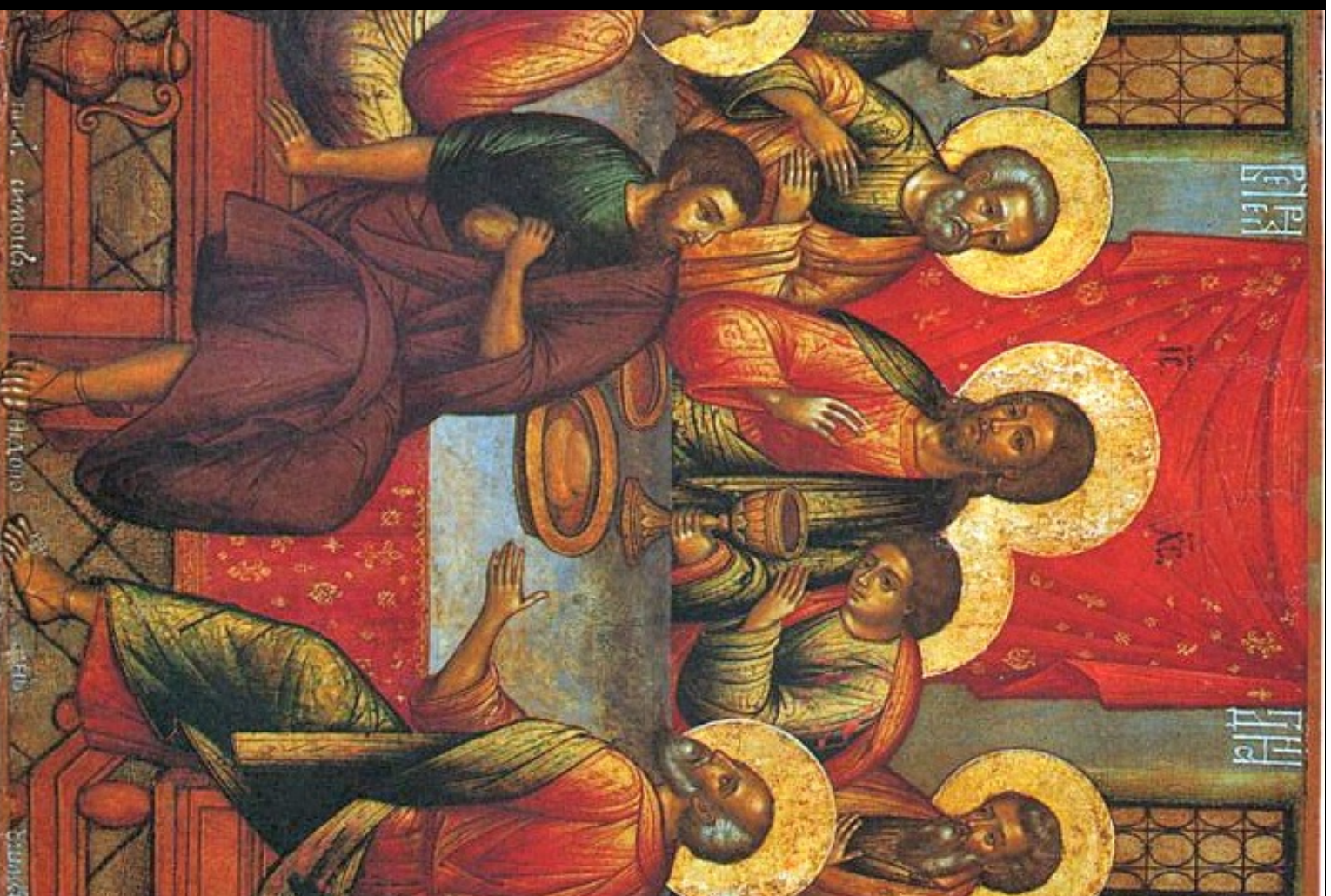
## HEBREW CALENDAR

- Luni-solar calendar described in Hebrew Scriptures
- Lunar: 12 months—based on inference from scripture (e.g. 1 Kings 4:7, where the 12 tribes had to each provide food for the king for one month)
- First month (Nisan) is placed near the vernal equinox
- Each month begins when the new moon is sighted at dusk by a committee of the Sanhedrin in Jerusalem
- Months are 29 or 30 days long, so the year is 11 days shorter than 365 days
- Solar: Every 3 years, a “leap month” is inserted to avoid drift of growing seasons through the calendar year



## THE PASSOVER FEAST

- Jewish passover feast celebrated on the full moon of the month of Nisan—on the 14th day of Nisan.
- Since Hebrew calendar is 11 days short, they added a month every 3 years (or so)
- Designed to keep Nisan—and Passover — as a spring feast
- Decision of whether to add a month was made by a head rabbi watching for a new moon.
- Impracticality of this system eventually led to tabulation (calculation) rather, than sighting of new moon
- Calculations of moon phases were not very reliable.





## CALCULATING EASTER

- Christians decided to celebrate the Passion season during the Jewish season of passover.
- The resurrection would be celebrated two days after 14 Nisan...
- ...but only Jewish rabbis could say when Nisan began.
- Should Christians trust Jews to schedule their festival of Easter? Christians decided to do their own calculations of lunar and solar cycles.
- Jewish calculations were often poor—sometimes resulting in 2 Pascals in one year (between successive equinoxes)
- Cycles specify when the 14th day of “Christian Nisan” would be celebrated using the Julian calendar.



## THE COUNCIL OF NICEA AND THE QUARTO-DECIMAN CONTROVERSY

- Some Christians (e.g. St. Polycarp and Syrian Christians) continued to celebrate Easter 2 days after the Jewish specification of Nisan 14— which often was *not* on a Sunday.
- Other Christians celebrated Easter on Sunday after the Christian/Julian specification of Nisan 14.
- Council of Nicea (325 A.D.) formalized the date on which Easter would be celebrated.
- Christian astronomers began to use churches as observatories to refine their calendars



## CATHEDRALS AS SOLAR OBSERVATORIES

- To predict the date of the vernal equinox (and hence Easter) one must accurately measure the length of the solar year
- A hole in the south wall of a cathedral allowed light to fall on the floor
- The sun's image crossed a north-south "meridian" line at local noon
- The furthest north (south) positions of the sun's image indicate the dates of the winter (summer) solstices.



# ASTRONOMY, THE CHURCH AND THE CALENDAR

KERRY KUEHN

SAINT JOHN'S EV. LUTHERAN  
CHURCH, WAUWATOSA

SUNDAY BIBLE CLASS  
SEP. 20 - OCT. 25, 2015  
9:15 A.M.

